



ASSOCIATION OF AMERICAN RAILROADS

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July 10, 2008

Honorable Anne Quinlan
Acting Secretary
Surface Transportation Board
395 E St., S.W.
Washington, DC 20423

Re: STB Ex Parte No. 677 (Sub-No. 1) – Common Carrier Obligation of Railroads –
Transportation of Hazardous Materials

Dear Secretary Quinlan:

Pursuant to the Notice of the Board served June 4, 2008 (and supplemental procedural orders served June 19, and June 23, 2008), attached is the Written Testimony of the Association of American Railroads for filing in the above proceeding.

Respectfully submitted,

Louis P. Warchot
Attorney for the Association of
American Railroads

**BEFORE THE
SURFACE TRANSPORTATION BOARD**

STB EX Parte No. 677 (Sub-No. 1)

**COMMON CARRIER OBLIGATION OF RAILROADS---TRANSPORTATION OF
HAZARDOUS MATERIALS**

**WRITTEN TESTIMONY OF
THE
ASSOCIATION OF AMERICAN RAILROADS**

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Dated: July 10, 2008

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I. Introduction

By Notice served June 4, 2008 (and supplemental procedural order served June 19, 2008), the Surface Transportation Board ("Board") scheduled a public hearing for July 22, 2008 on the common carrier obligation of railroads with respect to the transportation of hazardous materials. The Association of American Railroads ("AAR"), whose members account for 75 percent of U.S. freight rail mileage, 92 percent of employees, and 95 percent of revenues, intends to testify at the hearing and hereby submits this written testimony as directed by the Board in its Notice.

The Board's Notice is an outcome of testimony provided by railroad industry and shipper community participants at the Board's April 24-25, 2008 public hearing in Ex Parte No. 677, Common Carrier Obligation of Railroads. The transportation of toxic inhalation hazard ("TIH") materials was one of the specific items on the Board's agenda in that proceeding and was the

subject of significant discussion at the hearing. As a principal focus of its testimony, the railroad industry, through the AAR and other railroad witnesses, noted that although rail is the safest mode of transportation for many hazardous materials, including TIH materials, the transportation of TIH materials as currently mandated under the railroads' common carrier obligation subjects the railroads to significant risks and raises the specter of "bet the company" exposure in case of the release of such materials.

In response to the Board's institution of this proceeding and the specific inquiries set forth in its Notice, the AAR presents the testimony below which addresses the scope of the railroads' common carrier obligation regarding TIH materials, the current untenable situation facing the railroads with respect to the transport of such materials, and proposals for Board action to address the current situation consistent with the common carrier obligation. Although the Board's Notice references hazardous materials generally, including TIH materials, the AAR's testimony will focus on TIH materials because of the extraordinary risk and exposure imposed upon the railroad industry due to the unique characteristics of such materials.¹

II. AAR Position on TIH Materials Transport

At the outset, the AAR wishes to make clear that it is not seeking at this juncture for the railroad industry to be relieved of its common carrier obligation to transport TIH materials. It is, however, asking the Board to issue a policy statement that will provide guidance as to what that obligation requires and permits. As the Board has long recognized, the railroads' common carrier obligation is not absolute. The Board has discretion in interpreting that obligation, and, as in all other matters before it, its discretion should be informed by the public interest.

¹ A description of the commodities that the railroads consider to be TIH materials is set forth in Attachment 1.

The AAR recognizes that rail transportation is the safest and most secure mode of transporting TIH materials generally and that many such materials currently play an important role in the national economy. The issue, from the railroad industry's perspective, is that if there is a public interest need for the railroads to be compelled to carry TIH materials, there is a corresponding public interest need for the industry to be able to take into account and protect itself against the increased risk and potentially ruinous liability exposure associated with transporting TIH. Such exposure could jeopardize not only the financial condition of individual carriers but also the financial health of the industry itself with attendant adverse effects on the ability of the railroad network to provide efficient and responsive rail services to the public in general. Accordingly, in this proceeding the industry does not seek relief from its current common carrier obligation to transport TIH materials, but instead asks that the Board: (1) recognize and approve the right of a rail carrier (if it chooses to do so) to establish, as conditions of transport, liability-sharing arrangements with shippers and find that such conditions are reasonable service terms for rail common carrier transportation of TIH materials; (2) consider the extraordinary costs of TIH materials transport in Board proceedings; and (3) support long-term policy solutions to address the open ended risk and exposure associated with TIH materials transport.

Specifically, the AAR first proposes that the Board issue a formal policy statement based on the record in these proceedings making clear that a railroad, if it chooses to do so, may establish common carrier service terms that: (1) require the shipper of TIH materials to indemnify the carrier for the full amount of any liability or exposure resulting from a release of TIH materials above a threshold level that would be the greater of the amount of insurance that

the railroad carries for such an incident or, for Class I railroads, \$500 million²; and (2) require the shipper to obtain insurance or other forms of assurance to support such indemnification at levels depending upon the circumstances of the TIH materials transportation (including the size and financial ability of the shipper).

The AAR's proposal is predicated on the premise that rail carriers would continue to assume liability for the risk of transporting TIH materials at the primary level and accept the normal risks of rail operations and accidents associated with the transport of any commodity. Rail carriers would, however, be provided assurance by the Board that they may require shippers to share the extraordinary risks presented by a potential release of the extra-hazardous TIH materials they have chosen to ship. Consistent with the common carrier obligation requirement to "provide service on reasonable request," the rights of rail carriers to "establish reasonable...rules and practices," and the public interest, both the carrier and the shipper would share the extraordinary liability risk of TIH transport. This shared liability would not only provide protection for the rail network against catastrophic exposure, but also act as an incentive for all stakeholders to seek to further reduce the risks associated with TIH material transport through operational changes in their respective industries and/or legislative action.

Second, the AAR proposes that the extraordinary cost of TIH materials transport resulting from the actions that railroads take to address and mitigate the specific dangers associated with the commodities themselves be recognized by the Board in STB proceedings. There are unique and significantly greater risks associated with TIH materials transport than with other commodities and the railroads must take unique and extraordinary measures in response to

² Minimum threshold levels of less than \$500 million would be established for Class II and Class III railroads. Also, this proposal assumes that at least \$500 million of insurance for TIH materials transport is commercially available for Class I carriers. If the insurance market changes, appropriate relief would be sought from the Board to address that circumstance.

those risks. The Board should allow the costs of those measures to be considered in rate reasonableness and any other relevant STB proceedings.

Third, while the first two AAR proposals would result in mitigating the significant risks, costs and potential liability for the railroads in transporting TIH materials, there remains the potential for catastrophic accidents and ruinous exposure as long as such commodities are transported at all. Thus, long-term solutions must also be sought to address more completely the ultimate concern that a single accident could not only be financially ruinous for a rail carrier but also have significant adverse consequences for public safety. As long as it is in the public interest to require railroads to transport TIH materials, public policy should favor appropriate protection for rail carriers against the risk associated with TIH materials and for the public to share or limit that risk. Accordingly, the Board should assist in identifying and lend its support to policy initiatives that would address the overall health and financial risks to the railroads and the public resulting from the release of TIH materials in transport.

III. The Common Carrier Obligation Does Not Preclude Railroads From Establishing Reasonable Conditions on TIH Materials Transport

As explained below, the AAR's proposals, and specifically the proposal to allow rail carriers to establish risk sharing terms with TIH shippers, are necessary under the current circumstances facing TIH materials transport and is consistent with Court, Board and Interstate Commerce Commission ("ICC") case law defining a reasonable practice under the common carrier obligation.

A. General Common Carrier Obligation of Rail Carriers

As the Board indicated in its Notice in this proceeding, the common carrier obligation derives from 49 USC § 11101(a), which requires that a carrier provide "transportation or service

upon reasonable request.” However, the common carrier obligation is not absolute and service requests must be reasonable. *See e.g., G.S. Roofing Prods. Co. v. STB*, 143 F.3d 387, 391 (8th Cir. 1998).

In assessing what constitutes a reasonable request, there are two avenues of inquiry. The first is whether the “request” for service is reasonable. As noted in Consolidated Rail Corp. v. ICC, 646 F.2d 642, 647 (D.C.Cir. 1981), “[l]ong ago the Supreme Court made it clear that ‘[no] party has the right to insist upon a wasteful or excessive service for which the consumer must ultimately pay.’” The second is the reasonableness of the carrier’s response to the request for service. A carrier is only required to take reasonable steps to provide adequate service under the circumstances and may “establish reasonable ...rules and practices in matters related to that transportation or service.” 49 U.S.C. 10702; *see, e.g., Granite State Concrete Co., v. STB*, 417 F.3d 85, 92-94 (1st Cir. 2005) (“Granite”); *see also Chicago & Northwestern Transp. Co. v. Kalo Brick & Tile Co.*, 450 U.S. 311, 325 (1981)).

The obligations of a carrier to “provide service on reasonable request” pursuant to section 11101(a), and to “establish reasonable...rules and practices” pursuant to section 10702, are not statutorily defined. As noted in Granite, 417 F.3d at 92-94: “The two statutory provisions ... do not provide precise definitions for the operative standards: section 11101 does not define what would constitute adequate service on reasonable request, and section 10702 does not define what would be reasonable rules and practices.” The Granite court (at 92) further ruled that under the statutory scheme of the ICC Termination Act of 1995 (“ICCTA”) the definition and scope of these terms are to be determined by the Board on a case-by-case basis in light of all the relevant facts and circumstance. *See also National Grain & Feed Ass’n v. United States*, 5 F.3d 306, 310

(8th Cir. 1993); Decatur County Comm'rs v. STB, 308 F.3d 710, 716 (7th Cir. 2002); GS Roofing Prods. Co. v STB, 143 F.3d 387, 392 (8th Cir. 1998).

The Board's broad discretion to determine the scope of the rail common carrier obligation under 49 U.S.C.11101(a) is in no manner nullified or circumscribed by the existence of safety – or security – regulations issued by the Department of Transportation (“DOT”) pertaining to the commodity or service at issue. Simply because DOT regulations may set standards for the way a specific hazardous material may be packaged or transported by rail, that does not modify or define the common carrier obligation of rail carriers to transport the materials.

As specifically recognized by the courts and the Board's predecessor agency (the ICC), DOT safety regulations govern only safety issues (and similarly security regulations govern security issues). Only the Board has jurisdiction under the ICCTA to determine the scope of the common carrier obligation (*i.e.*, what constitutes a “reasonable request” for service under 49 U.S.C. 11101(a) or a “reasonable rule or practice” under 49 U.S.C. 10702), and only the Board has jurisdiction to rule on economic issues pertaining to the rail transportation of hazardous materials, including with respect to insurance and liability issues. See, e.g., Akron, C. & Y. Ry. v ICC, 611 F.2d 1162, 1170 (6th Cir. 1979) (“Akron”) (“questions of safety [regarding rail transport of nuclear materials] are also questions of risk and liability. A question of possible liability for damage resulting from carriage of a commodity is therefore within the Commission's jurisdiction as the regulator of the economics of interstate rail transport”); see also Delta Airlines v. CAB, 543 F.2d 247, 259-260, 267 (D.C. Cir. 1976) (“Delta Airlines”); Radioactive Materials, Missouri-Kansas-Texas R.R., 357 ICC 458, 463-64 (1977) (“MKT”)

Thus, the Board can assess the risks of transport of a commodity in determining the reasonableness of a request for such transportation and the reasonableness of conditions placed upon common carriage transport in response to the request.

B. Common Carrier Obligation of Railroads in the Context of TIH Materials

The scope of the common carrier obligation of railroads to transport hazardous materials was the subject of a series of ICC cases originating in the late 1970's (the Akron and MKT cases). In those cases, the ICC examined the specific facts and circumstances relating to the carriers' efforts to "flag out" from or otherwise condition their common carrier obligations to transport the radioactive materials (spent nuclear fuel and radioactive waste) and, based on the record at that time, did not approve the carriers' request.

The only case of which the AAR is aware involving agency consideration of the rail common carrier obligation to transport TIH materials is Classification Ratings of Chemicals, Conrail, 3 ICC 2d 331 (1986) ("Conrail"). In that case, Conrail attempted to "flag out" from its common carrier obligation to transport TIH because the product was highly lethal (referencing the chemical disaster in Bhopal, India in 1984).³ In its "flag out," however, Conrail noted that it might be willing to provide the transportation as a contract carrier where it could more closely supervise and set terms for shipment handling, insurance and allocation of risk. See Conrail, at 337.

³ In the Bhopal accident, a lethal gas (methyl isocyanate) leaked from a Union Carbide India Limited (UCIL) pesticide plant in Bhopal, India. At least 3,800 people died and several thousand other individuals experienced permanent or partial disabilities. In 1989 the Supreme Court of India directed a final settlement of the Bhopal litigation in the amount of \$470 million. See Union Carbide Corporation statement on its website (www.Bhopal.com (2007)). The \$470 million settlement amount did not include extensive environmental clean-up costs. (The damage claims would potentially have been orders of magnitudes higher had the catastrophic disaster occurred in the U.S.)

In evaluating Conrail's attempt to limit its common carrier obligation to transport the TIH materials at issue, the ICC referenced its findings in the Akron and MKT cases and summarized them as follows:

“[W]hen a flag-out for the transportation of nuclear materials is involved, the Commission has relied on the extensive safety regulation by both DOT and [Nuclear Regulatory Commission] and the limitation on a carrier's liability under the Price-Anderson Act, and concluded ‘a railroad may not renege on its common carrier commitment to transport radioactive materials on the ground they are too hazardous, if, in fact, the minimum safety requirements of DOT and NRC are satisfied.’”

Id at 335 (quoting from DOE v Baltimore & O.R. Co., 364 ICC 951, 959 (1981)).

However, in the Conrail case, the ICC found that the hazardous materials case before it was different from the nuclear waste cases. “Nuclear materials are extensively regulated by both DOT and NRC, and carrier liability is limited by Federal law (the Price-Anderson Act). Only DOT regulates transportation safety of hazardous chemicals. Moreover, there are no limitations on carrier liability for the transportation of such commodities.” Conrail at 336. As further noted by the ICC: “[T]he Commission has discretion to determine if there may be limitations on a carrier's tariff publication/common carrier obligation [regarding transport of ultra-hazardous materials].... This determination will include an analysis of the hazard posed by the involved commodity, the need for stricter safety standards [than DOT's safety regulations], and financial evidence including insurance costs and the extent of carrier liability.” Conrail at 337.

The ICC ultimately denied Conrail's “flag out” attempt, but did so because it found that Conrail had failed to meet its evidentiary burden. In that regard, the ICC stated: “Conrail has presented no meaningful evidence on why it cannot accomplish what it seeks to do in a published tariff. It has not shown that it could not use the tariff (through publication of various rules) to limit liability or to gain greater control over when commodities are tendered and how they are handled.” Conrail at 337.

Consistent with the holding in the Conrail case, the Board can help delineate the appropriate limitations or conditions on a carrier's common carrier obligation, including with respect to the transportation of TIH materials. In the Conrail context, the ICC focused, in part, on an analysis of the hazard and the extent of carrier liability. That should be the same focus for the Board in this proceeding taking into account the current environment in which there is a greater risk of potentially catastrophic liability related to the rail transportation of TIH materials than in Conrail and growing opportunities to avoid such transport.

In this regard, the AAR does not dispute that the movement of TIH materials is governed by an extensive set of DOT regulations and Transportation Security Administration ("TSA") requirements that are intended to minimize the hazards of transporting TIH materials by rail. However, DOT regulations and TSA requirements, while adding to the costs of TIH materials transport, do not provide a clear legal shield for the railroads from potentially enormous exposure should there occur a catastrophic incident involving release of TIH materials. Moreover, the extent of potential carrier liability far exceeds the levels of commercial insurance carriers can practicably obtain.

Unlike in Conrail, the railroad industry is not seeking to "flag out" from its common carrier obligation to transport TIH materials. Instead the industry seeks to act upon the ICC's specific rulings in Conrail that a carrier may seek to address its higher costs and potentially enormous liability exposure for a TIH "chemical disaster" arising from the transportation of these materials through reasonable service rules governing common carrier service. Accordingly, the AAR, consistent with the Conrail decision, seeks a formal policy statement by the Board that a carrier may include specific terms in its common carrier service offerings involving TIH materials that address the immediate and significant concerns regarding carrier liability exposure

and that such offerings do not constitute unreasonable practices and are not unreasonable responses to requests for TIH materials transport.

C. Reasonable Practices of Railroads in the Context of TIH Materials Transport

Conditions on TIH materials transport in the present environment would not only be consistent with the railroads' common carrier obligation, but would also be reasonable practices under 49 U.S.C. 10702. What is a "reasonable practice" is dependent upon the circumstances with the appropriate question being "whether actions taken by [the carrier] are unreasonable." Granite State, 417 F3d at 92.⁴

The touchstone of a reasonable practice is a finding by the Board that a specific carrier rule or practice is predicated upon a legitimate and urgent carrier concern and represents "a reasonable accommodation between the [carrier's]... concerns and the petitioners' service needs." See Granite at 92-93. In the present context, the overriding risk, exposure, and safety concerns serve as an appropriate basis for a finding that a rail carrier imposing liability-sharing and indemnity requirements as a condition of rail common carrier transportation of TIH materials would be a reasonable means of mitigating railroad exposure consistent with the public interest.

IV. It is Reasonable for the Railroads to Require the Sharing of Risk and Liability for TIH Materials Transportation With Shippers

As noted above, the AAR's proposed policy statement would make it clear that if a carrier chooses to do so, it may establish liability sharing and indemnity arrangements for shippers of TIH materials as a condition of common carrier service. For the reasons explained

⁴ It should also be noted that "the burden has consistently been placed on complainants to prove the merits of an unreasonable practice claim." N. Am. Freight Car Ass'n v. BNSF Ry., STB Docket No. 42060 (Sub-No.1), 2007 WL 20123 (served Jan. 26, 2007), Slip Op. at 5, *affirmed*, North America Freight Car Ass'n v. STB, ___F.3d___, 2008 WL 2491983 (D.C.Cir. June 24, 2008).

below, there are compelling grounds at this time for the Board to clarify that carriers may impose such conditions.

A. The liability exposure to the railroads in transporting TIH materials are significant and are based upon the unique characteristics of TIH materials

Railroads typically transport approximately 100,000 carloads of TIH each year; and the railroads are proud of their hazmat safety record. In 2006 (the most recent year for which data are available), 99.996 percent of rail hazmat shipments reached their final destination without a release caused by an accident.

That record is the result of a concerted effort by the industry to ensure the safety of extra-hazardous materials. For example, railroads participate in DOT rulemakings on TIH safety and security issues; participate in industry committees that establish new standards for tank cars carrying TIH; help communities develop and evaluate emergency response plans; train or assist with the training of tens of thousands of emergency responders each year; provide emergency responders with critical information to help mitigate hazmat incidents; and use special operating procedures on trains carrying TIH in accordance with DOT handling and routing regulations.

Despite the railroads' overall favorable safety record, however, the current environment for the rail transportation of TIH materials is untenable. Accidents can, and unfortunately even though the odds are extremely minimal, will occur, even when the railroads are not at fault. Therefore, every time a railroad moves one of these shipments, it faces potentially ruinous liability.

Moreover, railroads face these huge risks for a tiny fraction of their business. Shipments of TIH constitute only about 0.3 percent of all rail carloads. The revenue that highly-hazardous materials generate does not come close to covering the potential liability to railroads associated with transporting this traffic.

The fact that the commodities move in accordance with Department of Transportation-approved safety regulations does not eliminate the problem or the concern. Given the level and complexity of railroad operations—the railroad “factory floor” is outdoors and more than 140,000 miles long—it is unrealistic to expect that no rail accidents will occur, especially when the railroads can do everything right and a third party can cause an accident (*e.g.*, automobiles running into sides of moving trains). Natural causes such as rains and flooding provide examples of the types of TIH release incidents that could occur even where the railroad is not at fault. In one instance, flash flooding washed out ballast underlying an industry track on the Union Pacific in a heavily populated area. Loaded chlorine cars were on the track at the time. Fortunately, no incident occurred because the cars remained on the track even though the support under the rail was washed away. Had the cars fallen off the track, they would have struck an exposed fuel transmission pipeline. In another instance, earlier this year, a tornado derailed a loaded chlorine car near Chicago, fortunately without a release of the commodity.

As noted above, while accidents involving highly-hazardous materials on railroads are exceedingly rare, railroads could be subjected to multi-billion dollar claims, even for accidents where the railroads do nothing wrong, because of the unusual characteristics of the TIH commodities themselves. Unfortunately, the potential enormous liability of the railroad industry for damage claims arising from accidental TIH releases is starkly demonstrated by actual examples of three tragic accidents involving TIH over the last few years. These examples also clearly demonstrate that it is the inherent nature of the materials themselves that create the potential for enormous carrier liability claims.

In its recent Notice of Proposed Rulemaking, Hazardous Materials; Improving the Safety of Railroad Tank Car Transportation, 73 FR 17818 (April 1, 2008), DOT examined in detail the

National Transportation Safety Board's (NTSB) findings regarding three recent accidents involving PIH (Poison Inhalation Hazard)/TIH releases⁵ from tank cars, which occurred between 2002 and 2005, in Minot, ND, Macdona, TX and Graniteville, SC. The NSTB's findings as reported by DOT are summarized as follows:

1. Minot, ND – The accident occurred at approximately 1:30 am on Jan 18, 2002 near Minot and resulted in the derailment of 31 cars of a 112-car train. Eleven of the 31 derailed cars were pressurized tank cars transporting anhydrous ammonia. Five of the tank cars ruptured and instantaneously released their contents. Approximately 146,000 gallons of anhydrous ammonia were released from those five cars. As a result, a toxic vapor plume covered the derailment site and the surrounding area. The plume rose approximately 300 feet and gradually expanded five miles downwind of the accident site. The remaining six cars also suffered from shell impacts and gradually released 74,000 gallons of anhydrous ammonia. One resident was fatally injured and 333 people suffered other injuries. NTSB credited the emergency response effort (the Fire Department ordered residents in the area to shelter-in-place) with the relatively low number of injuries (333 injuries in 11,600 persons affected). An industry source estimates the total losses from the accident as approximately \$125 million.⁶ (73 FR at 17826)

2. Macdona, TX- The accident occurred at approximately 5:00 am on June 28, 2004 and resulted in derailment of four locomotives and 36 cars belonging to two trains that collided. One of the derailed cars was a tank car transporting chlorine. The car was punctured and instantaneously released approximately 9,400 gallons of chlorine, and a toxic vapor plume engulfed the accident area to a radius of approximately 700 feet before drifting away from the site. The vapor cloud drifted with the wind and traveled toward several residential areas within the city of San Antonio. Sea-World, a large commercial entertainment venue, was about 10 miles northwest of Macdona in the path of the chlorine vapor cloud. Thirty-three persons were injured, three fatally. (73 FR at 17827-28.)

3. Graniteville, SC- The accident occurred at approximately 2:30 am on January 6, 2005 when a freight train struck a train on a rail spur leading to the Avondale Mills textile manufacturing facility. The collision resulted in the derailment of three locomotives and 17 cars, including three pressurized tank cars transporting chlorine. One of the tank cars was punctured and instantaneously released approximately 9,220 gallons of chlorine, creating a toxic vapor plume that engulfed the surrounding area. As a result of the chlorine release, 5,400 people within a 1- mile radius of the derailment site were evacuated for several days. Nine persons were fatally injured and 554 sustained other injuries. The NTSB noted that despite an effective emergency response, the eight civilian

⁵ The terms PIH and TIH as used by DOT are synonymous (see 73 FR 20752, 20757 (April 16, 2008) (DOT interim final routing regulations regarding hazardous materials)).

⁶ See Chicago SouthShore & South Bend R.R. ("Chicago SouthShore") April 17, 2006 written testimony in Ex Parte No. 677 at 8.

fatalities were determined to have died from asphyxia that occurred within minutes of exposure to the chlorine gas. Avondale Mills reported that it was unable to recover financially from the accident and closed its 10 mills in SC and GA. (73 FR at 17827-28) (On April 7, 2008, NS also reached a confidential settlement with Avondale Mills (which alone asserted claims against NS for \$420 million). Publicly available information indicates that claims of all parties affected by the Graniteville accident will exceed \$500 million, not including extensive environmental remediation costs.)⁷

In its April 1, 2008 NPRM, DOT also included a “what if” analysis regarding the three accidents. As found by DOT:

“Each of the three accidents discussed...above share certain similarities that effectively minimized the catastrophic results of the accidents. Each accident occurred in a relatively rural area, thereby limiting the population exposed to the hazardous materials release. Each accident occurred during the early morning hours, while most of the surrounding populations were in their homes and not in the immediate accident vicinity. The meteorological conditions at the time of each accident effectively limited the speed at which the resulting toxic plumes expanded and the distance over which the plumes expanded. Had any of the accidents occurred in a more densely populated area or later in the day, it is likely that many more people would have been exposed to the toxic plumes. Had the meteorological conditions at the time of any of the accidents been different (e.g., wind speed or direction, temperature, barometric pressure, or humidity) it is possible that the plumes could have expanded more than what actually occurred, again, exposing many more people to the toxic chemicals....” (73 FR at 17829)

As is evident from the DOT analysis, an accident involving the transportation of TIH is of a far different nature and magnitude than a normal railroad accident involving a derailment or collision resulting in spillage or release of lading, and the difference is predicated solely on the nature of the TIH lading itself. A train accident involving the spillage or release of coal, corn oil, or some other non-TIH material will likely be limited to a confined area near the accident site and cause a relatively localized amount of personal injury or property damage, no matter how severe the accident or how it occurred. As the three accidents discussed by DOT demonstrate, however, a TIH accident resulting in a release is not localized and has the potential to cause extensive death, injury and property damage miles away from the accident site.

⁷ See April 7, 2008 news release on NS website. See also, Associated Press, Meg Kinnard, SC Firm, Railroad Settle Suit Over Spill, April 7, 2008.

A TIH release is also not readily—if at all-- containable, no matter how rapidly an emergency response team may respond (or is able to respond due to the toxic nature of the release). The speed, path and destructive power of an accidental TIH release are based on the vagaries of wind, weather, time, geography, and population density of the surrounding areas. Should an accident occur within or near a densely populated area, or should there be a popular public attraction within a few miles of the site in the path of a toxic TIH plume (e.g., a Sea World as in the Macdona, TX accident) an accident resulting in a TIH release under unfavorable meteorological conditions has the potential to be truly catastrophic (on a scale even exceeding Bhopal) and result in billions of dollars in personal injury and property damage claims.

As an illustrative example, as noted in the April 17, 2008 written testimony of Chicago SouthShore in Ex Parte No. 677 (at 10), if an incident similar to the three accidents examined by DOT were to occur in a major city like Chicago with a population of approximately three million (and an estimated 12,750.3 people per square mile), “the results would be horrific.” As noted by Chicago SouthShore (in summarizing an economic analyst’s report):

“A recent study conducted by Risk Management Solutions, entitled *Catastrophe, Injury & Insurance: The Impact of Catastrophes on Workers Compensation, Life and Health Insurance* (2004) (the “RMS Study”), concluded that a rush hour rail accident in Chicago involving a chlorine release from a single car could result in 10,000 fatalities, 32,600 other casualties and more than \$7 billion in claims. RMS Study at 54-59. If such an incident involved the release of TIH from multiple cars, the losses would be considerably higher.”

It should also be noted that rail transportation of TIH is far riskier now than at the time of the Conrail case (1986). There are terrorism concerns that did not previously exist and that severely affect the risk profile of TIH materials transportation. Indeed, potential terrorist attacks on rail transportation of TIH materials are one of the principal focus points of the DOT’s April

16, 2008 final interim rule pertaining to safety and security for hazardous materials shipments.⁸

As noted by DOT (73 FR at 20752):

“The same characteristics of hazardous materials that cause concern in the event of an accidental release also make them attractive targets for terrorism or sabotage. Hazardous materials in transportation are frequently transported in substantial quantities and are potentially vulnerable to sabotage or misuse. Such materials are already mobile and are frequently transported in proximity to large population centers. Further, security of hazardous materials in the transportation environment poses unique challenges as compared to security at fixed facilities....”

The terrorism risk presented by TIH materials is also the focus point of TSA proposed rules regarding rail transportation security.⁹ As noted by TSA: “[TIH materials] present a significant rail transportation security risk and an attractive target for terrorists because of the potential for them to use these materials as weapons of mass effect.” 71 FR at 76861.

Unfortunately, although a rail carrier may exercise the utmost diligence under its own safety and security procedures and in accordance with new and proposed federal requirements (as further discussed in Section V below), there simply is no guarantee that a successful terrorist attack resulting in a release of TIH materials cannot occur at some location on a carrier’s extensive rail network and cause catastrophic damage. Similarly, there is no guarantee that a rail carrier would not be the subject of potential liability claims in the event of a successful terrorist attack resulting in a release of TIH materials based on assertions, however unfounded, that the carrier was somehow remiss in its safety or security responsibilities.

⁸ Docket No. PHMSA-RSPA-2004-18730, Hazardous Materials: Enhancing Rail Transportation Safety and Security for Hazardous Materials Shipments, 73 FR 20752 (April 16, 2008).

⁹ TSA NPRM (71 Fed. Reg. 76852 (Dec. 21, 2006)).

Not only are there new terrorism concerns, there is also far more traffic and congestion on the rail network that could potentially increase the risk of accident.¹⁰ There are also multitudinous new population and commercial centers that were formerly rural, increasing the potential for enormous liability claims for personal injury and property damage should a TIH release occur on what previously was an isolated portion of the rail network.

The legal landscape is also perilous, with potentially enormous jury awards predicated on a “deep pockets” approach. Railroads do not own tank cars holding TIH materials, do not load the tank cars, are not responsible for maintenance of the tank cars, and cannot ensure by inspection against leakage of the tank cars. Yet, if a tank car transporting TIH materials were to develop a leak and result in a release of TIH materials causing personal injury or property damage, there is little doubt that there would be claims filed against the carrier and the outcome in the litigation process would by no means be a certainty. Under our jury system, it is a fact of life that a carrier can be exposed to, and be found responsible for, enormous damage claims even where they were not at fault.

On the basis of the uniquely dangerous characteristics of TIH materials and the significant risk and exposure to the railroads in transporting such commodities, the AAR believes it is not a “reasonable” request for a shipper to ask the railroads to transport TIH materials at this

¹⁰ As the National Surface Transportation Policy and Revenue Study Commission recently noted, “Congestion [is affecting] every mode of surface transportation for ever-lengthening periods each day, as a result of the mismatch between demand and supply of limited capacity.” (Report of the National Surface Transportation Policy and Revenue Study Commission, Volume 1, p. 4.) The magnitude of the looming freight rail capacity issue was also borne out by a recent study by Cambridge Systematics, a prominent economic and transportation consulting firm. The purpose of the study, which focused on 52,000 miles of primary rail corridors, was to estimate the cost of the expansion in capacity necessary for U.S. freight railroads to handle the 88 percent increase in freight rail traffic forecast by the DOT for 2035. The study found that if rail capacity needs are not properly addressed, by 2035 some 16,000 miles of primary rail corridors — nearly one-third of the 52,000 miles covered in the study — will be so congested that a comprehensive service breakdown environment on the railroads affected would exist. Because the rail system is so interconnected, this outcome would mean that the entire U.S. freight rail system would, in effect, be disabled.

time without agreeing, if so requested, to share with the shippers the significant exposure resulting from such transport.

B. The Proposed Policy Statement Clarifying That Rail Carriers May Impose Conditions on the Transportation of TIH Materials is Consistent with the Public Interest

Railroads do not produce TIH materials, do not use TIH materials, do not own the tank cars used to transport TIH materials, and do not make the decisions on where TIH materials will be transported. Yet, under their current common carrier obligation, railroads are the only participants in the production, distribution and consumption chain for TIH materials that are required to handle these commodities. Indeed, even among transportation companies, railroads are the only entities required to handle TIH materials – no one requires motor carriers, barge or vessel operators or air transporters to handle this traffic.

An interpretation of the railroads' common carrier obligation where the enormous, uninsurable liability risk arising out of the distribution of TIH materials is placed upon the rail carriers instead of shared with the manufacturers and users of TIH materials would represent a seriously misguided public policy. Doing so would provide little or no incentive to manufacturers and users of TIH materials to develop and substitute safer products or to limit the public's exposure to TIH materials transportation movements to the minimum extent possible.

Today there are many substitute products for TIH materials (including, for example, substitutes for chlorine and anhydrous ammonia). Although the existence of these substitute products may not currently eliminate the need for TIH materials for some commercial and agricultural uses, there should be strong incentives in place for manufacturers and users to replace, where feasible, TIH materials and other highly-hazardous materials with less hazardous substitutes and new technologies. As the National Research Council (part of the National

Academy of Sciences) has noted, “the most desirable solution to preventing chemical releases is to reduce or eliminate the hazard where possible, not control it.” (Terrorism and the Chemical Infrastructure: Protecting People and Reducing Vulnerabilities, National Research Council – Board on Chemical Sciences and Technology, May 2006, p. 106). This can be achieved by “modifying processes where possible to minimize the amount of hazardous material used” and “[replacing] a hazardous substance with a less hazardous substitute.” *Id.* In a similar vein, in a January 2006 report, the Government Accountability Office (“GAO”) recommended that the Department of Homeland Security (“DHS”) “work with EPA to study the advantages and disadvantages of substituting safer chemicals and processes at some chemical facilities.” [*Homeland Security: DHS is Taking Steps to Enhance Security at Chemical Facilities, but Additional Authority is Needed*, GAO, Jan. 2006, p.7.] And the Center for American Progress (“CAP”) in an April 2007 report¹¹, notes that “the only way to truly protect communities is to get unnecessary toxic cargoes off the tracks.” (CAP report at 1).

There are many real-world examples to make the case for using safer chemicals. According to the CAP, some 25 water utilities no longer receive chlorine gas by rail, and now use safer and more secure treatments like liquid bleach or ultraviolet light. “As a result,” noted the CAP report, “more than 26 million people no longer live within range of a chlorine gas release from these facilities, and additional millions are no longer in danger from rail shipments to these facilities.” (CAP report at 8.) One facility referenced in the CAP report was the Blue Plains wastewater treatment facility, just a few miles from the U.S. Capitol. The facility used chlorine to disinfect water until shortly after 9/11 when the facility switched to sodium hypochlorite, a safer alternative. (CAP report at 13) Also, a March 2007 GAO report (at p. 14, Table 1) lists 23 large wastewater treatment facilities located throughout the country that have

¹¹ Attached as Attachment 2.

recently converted or plan to convert from chlorine gas to a safer alternative. (GAO, *Securing Wastewater Facilities: Costs of Vulnerability Assessments, Risk Management Plans, and Alternative Disinfection Methods Vary Widely*, March 2007.)¹² Railroads recognize that the use of TIH materials cannot be immediately halted. However, over the medium to long-term, using safer chemicals would go a long way in reducing hazmat risks.

As noted above, current policies relating to the rail transportation of TIH materials, however, do not provide appropriate incentives for reducing or eliminating unnecessary shipments of TIH. A more appropriate public policy would be one that encourages the entities who are making the decisions to produce, ship and use TIH materials to find product alternatives to TIH materials wherever possible. However, where product alternatives are not possible, public policy should also strongly discourage unnecessary shipment of TIH materials. This traffic should not be moving long distances across the country to further the commercial interests of producers or receivers when closer sources of supply are available. The current system works contrary to these goals. Far from discouraging unnecessary use or shipment of TIH materials, the current system will continue to encourage these activities by insulating TIH materials producers and receivers from the risks of their commercial decisions by allowing them to shift those risks to the railroads, which cannot refuse to handle the shipments under their current common carrier obligation.

The AAR's proposal is predicated on the premise that these problems can largely be addressed if rail carriers remain liable for the normal risks of rail operations and accidents associated with the transportation of hazardous materials other than TIH materials plus the primary risk of transporting TIH materials up to specific insurable limits. A rail carrier would be

¹² Attached as Attachment 3.

permitted, however, to require shippers to bear the extraordinary risks presented by a potential release of the extra-hazardous TIH materials they have chosen to ship by rail.

The AAR's proposal involves a reasonable and fair sharing of the risks. Where there is unknowable and unlimited liability exposure resulting from the inherent nature of the commodity itself, the risk inherent to that commodity is appropriately placed on the manufacturer/shipper of the dangerous commodity who is the main economic beneficiary of its manufacture and transportation. The railroads would still have the same strong incentives to operate safely, but they would no longer face the unwarranted and unreasonable levels of risk and exposure that give rise to the legitimate concerns discussed in these comments.

Moreover, the AAR believes that a clear interpretation of the common carrier obligation to permit liability sharing as proposed by the AAR would create an incentive for all the stakeholders, (*i.e.*, manufacturers, users, and railroads) to work together to find means to eliminate such exposure through the use of alternate products, changes in manufacturing locations, or legislative or policy initiatives such as discussed in Section VI below.

C. The Board Can Confirm that the Railroads Can Condition TIH Materials Transport Through the Issuance of a Policy Statement

The AAR, based upon the record at this hearing, submits that the Board should issue a general policy statement to the effect that:

It would not be an unreasonable practice for a rail carrier, under the provisions of 49 U.S.C. 11101(a) and 49 U.S.C. 10702, to require (if it elected to), as a condition of providing common carrier transportation services, that a TIH materials shipper indemnify and hold harmless the railroad against liability arising from a release of such materials in excess of (1) the maximum amount of insurance that the railroad carries for TIH transport or (2) \$500 million for Class I railroads, whichever is greater; and to provide reasonable assurances in the form of insurance or other means to support such indemnity.¹³

¹³ As noted above, separate minimum thresholds would be established for Class II and Class III railroads.

Because individual circumstances may vary, a carrier should also be allowed to establish conditions of transport setting lower thresholds of carrier liability (and, accordingly, higher levels of liability sharing with the shipper). Those conditions could be assessed by the Board on a case by case basis; however, if the carrier established conditions accepting liability at or above the specified threshold level that would be a “safe harbor” and such conditions would not be unreasonable. In addition, this proposal assumes that insurance is commercially available at the minimum threshold levels. If the insurance market changes and that is no longer the case, appropriate relief would be sought from the Board.

The Board has the authority to issue such a general policy statement, based on its findings at this hearing, under the provisions of the Administrative Procedure Act, 5 U.S.C. 553 (b) (APA) and the Board’s corresponding procedural rules. 49 C.F.R. 1110.3. Those provisions provide that a “general statement of policy...may be issued as final without notice or other public rulemaking proceedings.”

Such a general policy statement would note the Board’s intent with respect to determining the scope of the railroads’ common carrier obligation to transport TIH materials and would serve to advise the public prospectively as to how the Board proposed to exercise its considerable discretion in future cases. See, e.g., Iowa Power & Light Co. v Burlington N. Inc., 647 F2d 796, 811 (8th Cir. 1981) (“Iowa Power”) As further explained in Pacific Gas & Elec. Co. v FPC, 506 F2d 33, 38 (D.C. Cir. 1974):

“As an informational device, the general statement of policy serves several beneficial functions. By providing a formal method by which an agency can express its views, the general statement of policy encourages public dissemination of the agency’s policies prior to their actual application in particular situations. Thus the agency’s initial views do not remain secret but are disclosed well in advance of their actual application. Additionally, the publication of a general statement of policy facilitates long range planning within the regulated industry and promotes uniformity in areas of national concern.”

The AAR would also note that Board issuance of a general statement of policy in this proceeding based on the results of its Ex Parte No. 677 (Sub-No. 1) public hearing would be comparable in effect to the Board's handling of the fuel surcharge issue. In Ex Parte No. 661, Rail Fuel Surcharges, the Board, based on rail shipper concerns that "recent fuel surcharges collected by railroads are designed to recover amounts over and above increased fuel costs," conducted a public hearing on the issue. (See March 14, 2006 Notice of Public Hearing.) Following the hearing, the Board sought additional comment on certain proposals. However, based on the testimony at the hearing, the Board also issued a general policy statement admonishing the railroads to immediately halt the challenged practice. (See August 3, 2006 Notice at 4.)

V. The Unique Costs of TIH Materials Transportation Must be Recognized in Board Proceedings

In its Notice the Board requested comment on "whether there are unique costs associated with the transportation of hazardous materials, and if so, how railroads cover those costs."

Not only are railroads currently faced with potentially enormous liability for the transportation of TIH, they also bear the burden of a multitude of unique costs associated with TIH that they are currently precluded under STB rules from identifying in rate proceedings. See Simplified Standards for Rail Rate Cases, STB Ex Parte No. 646 (Sub-No.1) (STB served Sept. 5, 2007) ("Simplified Standards"). Those unique costs include costs of maintaining insurance that covers the higher risks associated with TIH materials transport and costs of compliance with safety and security operating procedures that each railroad has in place due to the enhanced risks associated with the commodities. These operating procedures result not only in capital and operating expenditures directly related to the activity, but also increased capital and operating

costs over the rail network (*e.g.*, reducing speed for a TIH materials train on a otherwise congested line slows the other trains on the line). A summary of recommended operating practices adopted by the rail industry through the AAR with respect to the transportation of hazardous materials is attached as Attachment 4. Also included in Attachment 4 is a brief description of the security initiatives that the industry has undertaken that relate to TIH materials transport.

Additional costs also result from special carrier operating procedures and risk assessments that are required to meet federal requirements for the security, handling and movement of TIH materials. Examples of these special procedures, which arise from DOT regulations, pending rulemakings, and TSA requirements are outlined below and are set forth in more detail in Attachment 5:

- Under current DOT rules, railroads must adopt security plans for TIH materials, including analyses of safety and security risks. See 49 CFR 172.800, 172.802, 172.820. Under DOT interim final rules,¹⁴ rail carriers must perform comprehensive safety and security risk assessments on existing hazmat routes and all “practicable alternative routes over which the carrier has authority to operate” and choose the route “presenting the fewest overall safety and security risks.” with attendant operational changes.
- Under proposed DOT rules applicable to TIH tank car specifications,¹⁵ a maximum allowable operating speed of 30 mph would apply in non-signal territory to TIH tank cars not meeting the proposed TIH tank car specification; a maximum operating speed of 50 mph would apply to all TIH tank car movements. (Proposed 49 CFR 174.86)
- Under proposed TSA regulations,¹⁶ a railroad must have a security coordinator; procedures to determine the location and shipping information for each TIH rail car under its physical custody and to be able to provide TSA with such information within one hour of request. There are also stringent requirements on transfers of cars containing TIH materials between interchanging railroads and between railroads and shippers or receivers. These include requirements that cars being transferred within a High Threat

¹⁴ Docket No. PHMSA-RSPA-2004-18730, Hazardous Materials: Enhancing Rail Transportation Safety and Security for Hazardous Materials Shipments, 73 FR 20752 (April 16, 2008).

¹⁵ (DOT NPRM) Docket No. FRA-2006-25169, Hazardous Materials: Improving the Safety of Railroad Tank Car Transportation of Hazardous Materials (73 FR 17818, 17862 (April 1, 2008)).

¹⁶ TSA NPRM (71 Fed. Reg. 76852, 882-884 (Dec. 21, 2006))

Urban Areas (“HTUA”), or which may subsequently enter an HTUA, may not be left unattended at any time during the transfer of custody. (Proposed 49 CFR 1580.101; 1580.103; 1580.105; 1580.107)

- Under other TSA initiatives, railroads have undertaken security measures resulting from HTUA vulnerability assessments including installation of lights, fences, intrusion detection devices, smart cameras, special positioning of TIH cars when stationary in HTUAs, movement of TIH car interchange points to locations outside HTUAs and reduction in TIH dwell time. (See *e.g.*, Attachment 5.)

Under the Board’s current rules governing small shipper cases (under which all or most TIH materials rate proceedings are likely to be decided) these unique costs are not allowed to be allocated directly to TIH material shippers. Use of movement-specific TIH materials costs are not permitted in small-shipper maximum rate proceedings; only system-wide URCS costs are permitted to be used for maximum reasonable rate determinations. See Simplified Standards slip op. at 58.

AAR submits that the Board’s current rules governing small-shipper rate cases, as applicable to TIH materials movements, currently operate (and will increasingly operate) to unfairly prevent carriers from recovering the unique costs attributable to TIH materials movements in the rates that carriers are permitted to charge TIH materials shippers. Instead, the current rules, which are predicated on system-average costs, spread these costs over the entire shipper community to the extent possible. The current rules accordingly prevent rail carriers from reflecting the unique costs of TIH materials transportation from TIH material shippers in maximum rate cases while requiring the entire shipping community (to the extent the railroads are able to allocate these costs across their entire traffic base) to cross-subsidize TIH material shippers. This is unfair to both rail carriers and to the rail shipper community as a whole.

VI. Legislative and Policy Approaches, Such as Price Anderson Act Type Legislation, Should be Explored as a Long-Term Solution, But Should Not be a Substitute for Immediate Board Action

In its Notice, the Board requested comment on “potential policy solutions to the liability issue, including solutions modeled on the Price Anderson Act.” The Board also requested comment “on the appropriate role of the Board in developing such a policy solution.”

The Board clearly has the authority to lend support to and advocate a legislative/policy solution along the lines of a Price Anderson Act or other approach. The common carrier liability issue is an economic issue directly within the Board’s jurisdiction (see Conrail) and the financial soundness of the railroad industry is a central tenet of Rail Transportation Policy. (*e.g.*, 49 U.S.C. 10101(3), (4), (5) and (8)). The Board has appropriate authority to propose legislation and comment on legislation in areas of agency concern. However, the Board’s authority should be exercised in this context taking into account two fundamental considerations.

First, it should be understood that a legislative/policy approach would not be a substitute for a Board policy statement at this time clarifying the rail common carrier obligation as proposed in Section IV above. The enormous potential liability associated with the transportation of TIH materials is a matter of immediate urgency to the industry. The AAR’s request for a clarification concerning the reasonableness of liability sharing/indemnity under the railroads’ common carrier obligation is a necessary and reasonable means of addressing the currently untenable situation as promptly as possible. A legislative/policy initiative is, by its nature, an uncertain and long-term process. Accordingly, the AAR views any legislative/policy approach as complementary, but not as a substitute for its proposal in these comments.

Secondly, any long-term legislative/policy approach needs to identify and focus on the appropriate objective. A Price Anderson Act type legislative approach would have as an

objective overall limitations on liability for the transport of TIH materials. The Price-Anderson Act limits the liability of a company from an incident involving the release of nuclear material, including in transportation, and provides for a fund to which all nuclear power plant licensees contribute when an incident occurs to cover any damages in excess of required insurance levels. Under a similar type of proposal for TIH materials, railroads, TIH materials shippers, and tank car owners, lessors, and manufacturers would be required to maintain insurance and be liable for a defined amount of damages arising from a release of TIH materials. Any damages above that defined amount would be paid from a fund to which shippers of these materials would contribute on a pre- and post-incident basis up to a statutory maximum payment per incident. In this context, following the Price Anderson Act approach, the railroads would be treated as “contractors” with more limited liability than the shippers who, as discussed above, have the option whether to make and use TIH materials, and gain profit from doing so.¹⁷

Although Price Anderson Act type legislation would be similar, in many respects, to the AAR’s proposal in Section IV, a legislative enactment would provide a greater degree of certainty as to the rights and obligations of the carriers and shippers. It would also provide for the sharing of risk and exposure relating to TIH materials transport over a broader group to include the public at large, because such type of legislation would be premised on the public need for the use – and, accordingly, the transport – of TIH materials and the corresponding public recognition that there should be limitations and sharing of the liability involved in TIH materials transport.¹⁸

¹⁷ The AAR has, in concert with the American Short Line and Regional Railroad Association, developed proposed legislation as generally described above.

¹⁸ Also, there may be other means to effect liability limitations. For example, Congress could create a statutory liability cap for the railroads similar to the one that applies to passenger operations. The railroads’ total liability for all claims, including punitive damages, from a single accident — regardless of fault — is capped at \$200 million. 49 U.S.C. 28103.

While the policy goal of sharing and/or limiting liability for the transportation of TIH materials is desirable based upon the fundamental premise that such transport is necessary, legislation in furtherance of such a goal would not necessarily improve public safety. If the ultimate goal is improving safety, another legislative policy option – which is not mutually exclusive – would also be to explore legislative incentives to eliminate the transport of TIH materials over the long-term through product substitution, co-location, or other means. The Board should encourage the exploration of all types of long-term legislative/policy solutions to the present untenable situation and should take action to incent carriers and shippers to achieve consensus on any such policy solutions.

VII. Conclusion

The rail industry currently faces an untenable situation regarding the transport of TIH materials. While the amount of TIH materials transported by rail is minimal, the transportation of such materials exposes railroads to significantly higher costs and potentially ruinous liability due to the extraordinarily dangerous characteristics of the commodities themselves. Nonetheless, as a result of their common carrier obligation, the railroads must transport the TIH materials and be subject to the attendant costs, risks, and exposure.

The AAR, at this time, does not seek for the railroads to be relieved of their common carrier obligation to transport TIH materials. However, if there is a public interest need for TIH materials to be transported, there is a corresponding public interest need for the railroads to be protected against the higher costs and potentially ruinous exposure uniquely associated with TIH transport.

With respect to costs, the Board should take action to recognize in STB proceedings the extraordinary costs to the railroads involved with TIH materials transport that must be incurred to address and mitigate the dangers associated with the commodities.

The Board should also take action to incent and support legislative/policy approaches that would address both the liability and safety concerns associated with the movement of TIH materials. However, legislative initiatives, by their nature, are uncertain and long-term processes. The significant risks and exposure to which the railroads are subject are concerns that need to be immediately addressed.

Accordingly, the Board should issue a policy statement based on the record in this proceeding that a railroad, if it chooses to do so, may establish common carrier service terms that: (1) require the shipper of TIH materials to indemnify the carrier for the full amount of any liability or exposure resulting from a release of TIH materials above a threshold level that would be the greater of the amount of insurance that the railroad carries for such an incident or, for Class I railroads, \$500 million; and (2) require the shipper to obtain insurance or other forms of assurance to support such indemnification at levels depending upon the circumstances of the TIH materials transportation.

ATTACHMENT 1

Attachment 1
Toxic-by-Inhalation (TIH) Materials Currently Transported By Rail *

DOT Proper Shipping Name	UN/NA# **
NON-FLAMMABLE GASES, HAZARD CLASS 2.2	
Ammonia, Anhydrous	UN 1005
Ammonia, Solution	UN 3318
POISON GASES, HAZARD CLASS 2.3	
Ammonia, Anhydrous	UN 1005
Ammonia, Solution	UN 3318
Arsine	UN 2188
Boron Trichloride	UN 1741
Boron Trifluoride	UN 1008
Bromine Chloride	UN 2901
Carbon Monoxide and Hydrogen mixture, Compressed	UN 2600
Carbon Monoxide, Compressed	UN 1016
Carbon Monoxide, refrigerated liquid	NA 9202
Carbonyl Fluoride	UN 2417
Carbonyl Sulfide	UN 2204
Chlorine	UN 1017
Chlorine Pentafluoride	UN 2548
Chlorine Trifluoride	UN 1749
Chloropicrin and Methyl Bromide mixtures	UN 1581
Chloropicrin and Methyl Chloride mixtures	UN 1582
Coal Gas, Compressed	UN 1023
Compressed Gas, toxic, corrosive, n.o.s.	UN 3304
Compressed Gas, toxic, flammable, corrosive, n.o.s.	UN 3305
Compressed Gas, toxic, flammable, n.o.s.	UN 1953
Compressed Gas, toxic, n.o.s.	UN 1955
Compressed Gas, toxic, oxidizing, corrosive, n.o.s.	UN 3306
Compressed gas, toxic, oxidizing, n.o.s.	UN 3303
Compressed gas, toxic, oxidizing, n.o.s.	UN 3306
Cyanogen	UN 1026
Cyanogen Chloride, Stabilized	UN 1589
Diborane	UN 1911
Dichlorosilane	UN 2189
Dinitrogen Tetroxide	UN 1067
Ethylene Oxide and Carbon Dioxide mixture	UN 3300
Ethylene Oxide or Ethylene Oxide with Nitrogen	UN 1040
Fluorine, Compressed	UN 1045

* Compiled from AAR Circular OT-55-I (July 17, 2006), as amended by AAR CPC Circular 1182 (Sept. 21, 2007). The OT-55 list of TIH materials transported by rail is periodically revised. A complete DOT list of TIH materials (including TIH materials not currently transported by rail) is found at 49 C.F.R. § 172.101. The AAR's proposal is all inclusive and embraces all TIH materials listed at 49 C.F.R. § 172.101.

** UN identification numbers for international and domestic transportation; NA numbers for domestic transportation and transportation to Canada only. See 49 C.F.R. §172.101 (e).

Gas Identification set	NA 9035
Gas sample, non-pressurized, toxic, n.o.s.	UN 3169
Gas sample, non-pressurized, toxic, flammable, n.o.s.	UN 3168
Germane	UN 2192
Hexaethyl tetraphosphate and compressed gas mixtures	UN 1612
Hexafluoroacetone	UN 2420
Hydrogen Bromide, anhydrous	UN 1048
Hydrogen Chloride, anhydrous	UN 1050
Hydrogen Chloride, refrigerated liquid	UN 2186
Hydrogen Iodide, anhydrous	UN 2197
Hydrogen Selenide, anhydrous	UN 2202
Hydrogen Sulfide	UN 1053
Insecticide gases, toxic, flammable, n.o.s.	UN 3355
Insecticide gases, toxic, n.o.s.	UN 1967
Liquefied gas, toxic, corrosive, n.o.s.	UN 3308
Liquefied gas, toxic, flammable, corrosive, n.o.s.	UN 3309
Liquefied gas, toxic, flammable, n.o.s.	UN 3160
Liquefied gas, toxic, n.o.s.	UN 3162
Liquefied gas, toxic, oxidizing, corrosive, n.o.s.	UN 3310
Liquefied gas, toxic, oxidizing, n.o.s.	UN 3307
Methyl Bromide	UN 1062
Methyl Mercaptan	UN 1064
Methylchlorosilane	UN 2534
Nitric oxide and nitrogen dioxide mixtures or Nitric oxide and dinitrogen tetroxide mixtures	UN 1975
Nitric Oxide, Compressed	UN 1660
Nitrogen Trioxide	UN 2421
Nitrosyl Chloride	UN 1069
Oil Gas, Compressed	UN 1071
Organic phosphate, mixed with compressed gas or Organic phosphate compound, mixed with compressed gas or Organic phosphorus compound, mixed with compressed gas	NA 1955
Oxygen Difluoride, Compressed	UN 2190
Parathion and Compressed gas mixture	NA 1967
Perchloryl Fluoride	UN 3083
Phosgene	UN 1076
Phosphine	UN 2199
Phosphorus Pentafluoride	UN 2198
Selenium Hexafluoride	UN 2194
Silicon Tetrafluoride	UN 1859
Stibine	UN 2676
Sulfur Dioxide	UN 1079
Sulfur Tetrafluoride	UN 2418
Sulfuryl Fluoride	UN 2191
Tellurium Hexafluoride	UN 2195
Trifluoroacetyl Chloride	UN 3057

Trifluorochloroethylene, Stabilized	UN 1082
Tungsten Hexafluoride	UN 2196
FLAMMABLE LIQUIDS, HAZARD CLASS 3	
Ethyl Isocyanate	UN 2481
Isobutyl Isocyanate	UN 2486
Isopropyl Isocyanate	UN 2483
Methacrylonitrile, Stabilized	UN 3079
Methoxymethyl Isocyanate	UN 2605
SPONTANEOUSLY COMBUSTIBLE, HAZARD CLASS 4.2	
Pentaborane	UN 1380
OXIDIZERS, HAZARD CLASS 5.1	
Bromine Pentafluoride	UN 1745
Bromine Trifluoride	UN 1746
Tetranitromethane	UN 1510
POISONS, HAZARD CLASS 6.1	
2-Chloroethanal	UN 2232
2-Methyl-2-Heptanethiol	UN 3023
3, 5-Dichloro-2, 4, 6-Trifluoropyridine	NA 9264
Acetone Cyanohydrin, Stabilized	UN 1541
Acrolein, Stabilized	UN 1092
Allyl Alcohol	UN 1098
Allyl Chloroformate	UN 1722
Allylamine	UN 2334
Arsenic Trichloride	UN 1560
Bromoacetone	UN 1569
Chloroacetone, Stabilized	UN 1695
Chloroacetonitrile	UN 2668
Chloroacetyl Chloride	UN 1752
Chloropicrin	UN 1580
Chloropivaloyl Chloride	NA 9263
Crotonaldehyde, Stabilized	UN 1143
Cyclohexyl Isocyanate	UN 2488
Diketene, Stabilized	UN 2521
Dimethyl Sulfate	UN 1595
Dimethylhydrazine, Symmetrical	UN 2382
Dimethylhydrazine, Unsymmetrical	UN 1163
Ethyl Chloroformate	UN 1182
Ethyl Phosphonothioic Dichloride, Anhydrous	NA 2927
Ethyl Phosphonous Dichloride, Anhydrous pyrophoric liquid	NA 2845
Ethyl Phosphorodichloridate	NA 2927
Ethylidichloroarsine	UN 1892
Ethylene Chlorohydrin	UN 1135
Ethylene Dibromide	UN 1605

Ethyleneimine, Stabilized	UN 1185
Hexachlorocyclopentadiene	UN 2646
Hydrocyanic acid, aqueous solutions or Hydrogen cyanide, aqueous solutions	UN 1613
Hydrogen Cyanide, solution in alcohol	UN 3294
Hydrogen Cyanide, stabilized	UN 1051
Iron Pentacarbonyl	UN 1994
Isobutyl Chloroformate	NA 2742
Isopropyl Chloroformate	UN 2407
Methanesulfonyl Chloride	UN 3246
Methyl Bromide and Ethylene dibromide mixtures, liquid	UN 1647
Methyl Chloroformate	UN 1238
Methyl Chloromethyl Ether	UN 1239
Methyl Iodide	UN 2644
Methyl Isocyanate	UN 2480
Methyl Isothiocyanate	UN 2477
Methyl Orthosilicate	UN 2606
Methyl Phosphonic Dichloride	NA 9206
Methyl Phosphonous Dichloride, pyrophoric liquid	NA 2845
Methyl Vinyl Ketone, Stabilized	UN 1251
Methyldichloroarsine	NA 1556
Methylhydrazine	UN 1244
n-Butyl Chloroformate	UN 2743
n-Butyl Isocyanate	UN 2485
Nickel Carbonyl	UN 1259
n-Propyl Chloroformate	UN 2740
n-Propyl Isocyanate	UN 2482
Perchloromethyl Mercaptan	UN 1670
Phenyl Isocyanate	UN 2487
Phenyl Mercaptan	UN 2337
Phenylcarbylamine Chloride	UN 1672
Phosphorus Trichloride	UN 1809
sec-Butyl Chloroformate	NA 2742
tert-Butyl Isocyanate	UN 2484
Thiophosgene	UN 2474
Toxic by Inhalation liquid, corrosive, n.o.s.	UN 3390
Toxic by Inhalation liquid, corrosive, n.o.s.	UN 3389
Toxic by Inhalation liquid, flammable, n.o.s.	UN 3384
Toxic by Inhalation liquid, flammable, n.o.s.	UN 3383
Toxic by Inhalation liquid, n.o.s.	UN 3382
Toxic by Inhalation liquid, n.o.s.	UN 3381
Toxic by Inhalation liquid, oxidizing, n.o.s.	UN 3388
Toxic by Inhalation liquid, oxidizing, n.o.s.	UN 3387
Toxic by Inhalation liquid, water-reactive, n.o.s.	UN 3386
Toxic by Inhalation liquid, water-reactive, n.o.s.	UN 3385
Trimethoxysilane	NA 9269

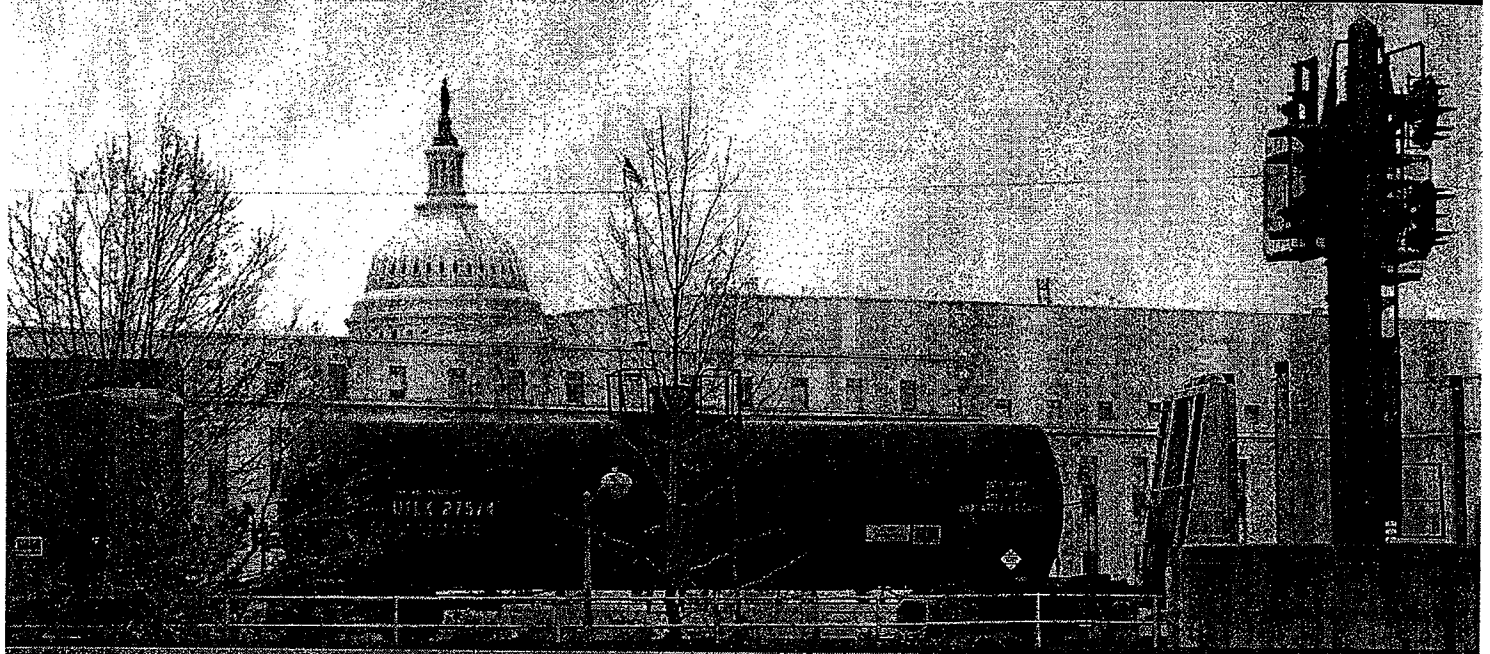
Trimethylacetyl Chloride	UN 2438
Waste Allyl Alcohol	UN 1098
Waste Hexachlorocyclopentadiene	UN 2646
Waste Toxic Liquid, corrosive, inorganic, n.o.s.	UN 3289
CORROSIVES, HAZARD CLASS 8	
Boron Tribromide	UN 2692
Bromine or Bromine Solutions	UN 1744
Bromine Solutions	UN 1744
Chlorosulfonic Acid	UN 1754
Ethyl Chlorothioformate	UN 2826
Hydrogen Fluoride, Anhydrous	UN 1052
Nitric Acid, red fuming	UN 2032
Phosphorus Oxychloride	UN 1810
Sulfur Trioxide, Stabilized	UN 1829
Sulfuric acid, fuming	UN 1831
Sulfuryl Chloride	UN 1834
Titanium Tetrachloride	UN 1838
Trichloroacetyl Chloride	UN 2442
Waste Sulfuric acid, fuming	UN 1831

ATTACHMENT 2

Center for American Progress



Toxic Trains and the Terrorist Threat



*How Water Utilities Can Get Chlorine Gas Off
the Rails and Out of American Communities*

Paul Orum

TOXIC TRAINS AND THE TERRORIST THREAT

How Water Utilities Can
Get Chlorine Gas Off
the Rails and Out of
American Communities

By Paul Orum

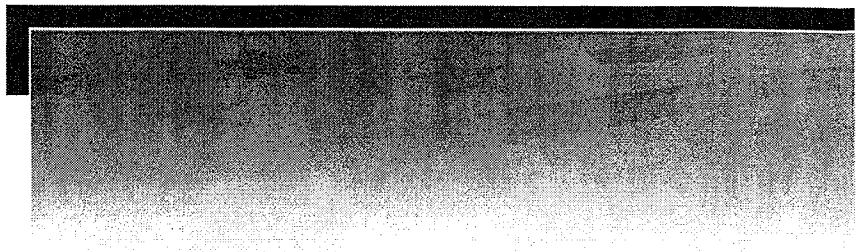
Reece Rushing, Project Manager

Director of Regulatory and Information Policy,
Center for American Progress

April 2007

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Executive Summary

Each year, thousands of tons of highly toxic chlorine gas travel by rail in the United States to drinking water and wastewater treatment facilities and other industries. These massive railcars traverse some 300,000 miles of freight railways, passing through almost all major American cities and towns. A rupture of one of these railcars could release a dense, lethal plume for miles downwind, potentially killing or injuring thousands of people.

The Department of Homeland Security and numerous security experts have repeatedly warned that terrorists could use industrial chemicals as improvised weapons of mass destruction—and indeed, terrorists recently attacked and blew up several trucks carrying chlorine in Iraq. In this respect, railcars of chlorine gas represent a distinct national security vulnerability. Yet Congress and the Bush administration have not acted to eliminate unnecessary uses of chlorine gas railcars even where undeniably affordable and practical alternatives exist.

To examine this vulnerability and encourage action, the Center for American Progress surveyed water utilities that still receive chlorine gas by rail, as well as utilities that since 1999 have eliminated chlorine railcars by switching to a less hazardous disinfectant. Our major findings are shown in the box on page 3.

Just 37 drinking water and wastewater treatment facilities still receive chlorine gas by rail. More than 25 million Americans live in harm's way near these facilities,¹ while millions more live in cities and towns along the rail delivery routes.

The good news is this vulnerability can be removed. Since 1999, some 25 water utilities that formerly received chlorine gas by rail have switched to safer and more secure water treatment options, such as liquid bleach or ultraviolet light. These alternative treatment options eliminate the danger of a catastrophic toxic gas cloud. As a result, more than 26 million Americans who live near these facilities are safer and more secure.

These conversions also remove the threat to communities along rail delivery routes. Railroads, by their nature, are wide open and largely insecure, providing easy access to railcars—as evidenced by the graffiti that frequently marks them (see photo on page 15). This makes it practically impossible to provide security commensurate with the risk presented by railcars of chlorine gas.

The only way to truly protect communities is to get unnecessary toxic cargoes off the tracks. Converting to safer alternatives for water treatment does that.

There continues to be some progress in this direction. At least six water utilities that now use chlorine-gas railcars are in the process of converting operations. Nonetheless, many others contacted by this survey have no plans to change.

Cost was a frequently cited reason for not converting. But the survey found such conversions are affordable even at large facilities, costing no more than \$1.50 per person served each year—or the price of a bag of potato chips—and often much less. Put another way, a single day's expenditures on the war in Iraq could cover construction costs of converting the remaining U.S. water utilities off chlorine gas railcars. Cost is not a sufficient justification to continue to jeopardize American communities with massive railcars of chlorine gas.

State and local governments may provide incentives for water utilities to switch from chlorine gas. But communities along the rails have little or no local control over toxic trains that pass by homes, workplaces, and schools. The plant conversions identified in this report are positive, but without a national strategy, these communities will be much less secure than they should be.

Washington, D.C., for example, quickly converted its sewage treatment plant from chlorine gas railcars to liquid bleach in the aftermath of the Sept. 11, 2001, terrorist attacks. But hazardous chemicals, including chlorine gas, are still being transported by rail through the District just a few city blocks from the U.S. Capitol building—an intended target on 9/11.

In response, the city government sought to reroute toxic trains around the city. The Bush administration, however, has backed

a lawsuit to block local control, arguing that local governments lack legal authority to protect citizens by rerouting trains.

The story is the same in other cities that have converted water utilities from chlorine-gas railcars, such as Cleveland and Indianapolis. Despite converting, these cities are still at risk from chlorine-gas railcars headed to other cities that have not converted, such as Minneapolis and Nashville.

A comprehensive solution can only come from the federal level. In fact, judges in the ongoing litigation over rerouting in Washington, D.C., have encouraged the Bush administration to develop a national strategy to address the security and safety dangers involved in the manufacture, use, and transportation of chlorine gas and other hazardous chemicals. Unfortunately, the administration and Congress have largely ignored this advice.

After years of inaction, and under growing public pressure, temporary and cosmetic chemical security legislation was enacted in October 2006 requiring the Department of Homeland Security to promulgate chemical-plant security regulations by April 4, 2007. But the legislation exempts water utilities, does not address transportation security concerns, and neglects safer and more secure technologies. Thus, among other shortcomings, DHS's new regulations will do nothing to address the risk posed to tens of millions of Americans by unnecessary rail shipments of chlorine gas to water utilities.

To address this danger and other chemical hazards, Congress must create meaningful national incentives. Among other actions, federal security standards should:

- Require chemical facilities to review and use available, cost-effective technologies that significantly reduce or eliminate serious emergency chemical release hazards;
- Target assistance to help water utilities convert from chlorine gas, including facilities that discontinued chlorine gas after Sept. 11, 2001;
- Give the Department of Homeland Security full authority to safeguard chemical infrastructure and the public, with appropriate roles for other governmental agencies; and
- Require chemical facilities to account for transportation risks—including the possibility of a catastrophic chemical release—in developing security assessments and plans.

Taking these actions would remove unnecessary toxic cargoes from the nation's railways and communities. The danger is immense and the solutions are clear. What we need now is action.

MAJOR FINDINGS

The Center for American Progress surveyed 62 water facilities that receive chlorine gas by rail or previously received chlorine gas by rail. These facilities treat an average of five billion gallons of drinking water and four billion gallons of wastewater each day, and serve more than 45 million people in two dozen states and the District of Columbia.² The survey identified facilities that have eliminated chlorine gas railcars, but also found others that have no plans to do so. Major survey findings include:

- **Only 24 drinking water and 13 wastewater facilities still use rail shipments of chlorine gas.** These facilities are found in California, Florida, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Missouri, Nebraska, South Carolina, Tennessee, Texas, Utah, and Virginia. These facilities endanger more than 25 million Americans who live nearby, and millions more near railways that deliver the chlorine gas.
- **At least six drinking water and 19 wastewater facilities have eliminated rail shipments of chlorine gas since 1999 by switching to a less hazardous disinfectant.** These facilities are found in California, the District of Columbia, Florida, Georgia, Indiana, Kentucky, Louisiana, Maryland, Michigan, Minnesota, New Jersey, New York, Ohio, Oregon, Pennsylvania, and Washington. Some 26 million people in nearby communities and millions more along rail delivery routes are no longer threatened by chlorine gas from these facilities. Additional water utilities eliminated chlorine gas rail shipments prior to 1999.³
- **Of facilities that still receive rail shipments of chlorine gas, at least four drinking water and two wastewater plants have definite plans to convert from chlorine gas to a safer, more secure disinfectant.** These facilities are found in Colorado, Florida, Kentucky, Louisiana, South Carolina, and Virginia. By converting, they will remove the threat to more than five million people living nearby, and millions more along their rail delivery routes. Several more such facilities are planning to convert within a few years, and others are evaluating alternatives.⁴
- **Chlorine gas rail shipments travel long distances through populated areas.** Some 16 chlorine production sites sell chlorine by rail to the merchant market. The profusion of freight rail lines precludes identifying specific routes between producers and water utilities. The locations of producers and chlorine-gas-using water utilities, however, make clear that rail shipments often cover hundreds or even thousands of miles.
- **General cost estimates provided by 20 water facilities indicate that switching from chlorine gas to a safer, more secure disinfectant is affordable.** Conversions at these facilities cost no more than \$1.50 per person served each year—or the price of a bag of potato chips—and often cost much less. A single day's expenditures on the war in Iraq could easily have paid to convert these 20 facilities off chlorine gas.

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Dangerous State of Play

Chemical Railcars Pose Serious Hazards

Exposure to chlorine gas can severely burn the eyes, skin, and lungs, and can be fatal. When released from a railcar, compressed chlorine expands rapidly into a ground-hugging poison gas cloud. A single ruptured railcar of chlorine gas can release a dense, lethal plume from 14 miles to 25 miles downwind in worst-case conditions.⁵ In large urban areas, thousands of people could be killed or seriously injured in these conditions.

The Department of Homeland Security estimates that a major chlorine railcar spill could kill 17,500 people.⁶ A Naval research lab likewise found that such a spill could quickly cause 100,000 serious injuries or deaths under a scenario involving large holiday crowds.⁷

This risk is especially worrisome given the vulnerability of railcars. A RAND Corp. database of worldwide terrorist incidents recorded over 250 attacks against rail targets from 1995 to 2005.⁸ Insurgents in Iraq have recently targeted trucks carrying chlorine gas with several deliberate attacks.⁹

The graffiti on many railcars attests to their vulnerability. A survey of rail workers reported widespread lax security at rail yards.¹⁰ Investigative news reports repeatedly show easy access to chemical facilities and rail cargoes.¹¹ A *Pittsburgh Tribune* reporter recently found so little security he could leave his business card on dozens of railcars and locations.¹²

Railcars may travel or sit near schools, hospitals, homes, and downtowns with only nominal security, if any. The railroad carrier may simply park the chlorine

railcar outside the water utility fence on an unpredictable schedule, leaving it for the facility to retrieve. Rail security regulations are minimal, yet because federal rules preempt state and local requirements, chemical railcars passing through communities are largely exempt from local control.

Major chlorine rail spills are infrequent but can be deadly. Chlorine rail spills killed eight people in Youngstown, Fla., in 1978; 17 people in Montanas, Mexico in 1981; three people near San Antonio, Texas in 2004; and nine people in Graniteville, S.C., in 2005. Since 1990, the National Response Center has recorded over 160 mostly-minor spill reports involving railroads and chlorine, or more than one every six weeks.¹³

Such spills reveal the overall vulnerability of the system. But a calculated terrorist rupture of a single chlorine-gas-filled railcar could have far worse consequences, potentially poisoning an entire community.

New Interim Chemical Security Rules Won't Fix the Problem

Many federal agencies and others have warned that terrorists could use chemical facilities as pre-positioned weapons of mass destruction.¹⁴ Yet there are almost no federal chemical security requirements. Congress enacted temporary legislation in October 2006 that requires the Department of Homeland Security to promulgate interim, stopgap chemical security requirements by April 4, 2007.¹⁵

But this new law is seen as an incomplete measure that will ultimately be replaced by comprehensive legislation. It has significant shortcomings that leave millions of Americans vulnerable. In particular, the new regulations:

"We are happy not to have the chlorine gas there. In the end it was a no-brainer to switch."

*Bill McKeon,
Chief Wastewater,
Philadelphia
Water Department,
Philadelphia, Pa.*

- Exempt drinking water and wastewater plants and other types of facilities;
- Do not require facilities to address the dangers, security costs, and potential liabilities of transporting extremely hazardous materials to or from their facilities; and
- Ignore cost-effective safer technologies that are the most effective way to reduce the attractiveness of chemical facilities as terrorist targets.

These regulations are too focused on physical security at facilities and do not do enough to emphasize supply chain security. Better fencing, lighting, and access controls are important, but insufficient—particularly if the delivery of hazardous materials to or from a facility travels by rail through a major urban center.

In 2006, the Transportation Security Administration released draft voluntary action items for securing rail transportation of toxic inhalation materials such as chlorine gas. Yet the voluntary recommendations lack enforcement, are vague on key elements (such as protecting railcars in transit), and are silent on feasible opportunities to take hazardous cargoes off the rails.

The Bioterrorism Act of 2002 provided substantial federal funding to drinking water facilities to conduct vulnerability assessments, but did not require these facilities to reduce any hazards or otherwise improve security. Similarly, there are no significant federal security standards for wastewater plants.

Homeland Security Presidential Directive 7 designated the U.S. Environmental Protection Agency as the lead agency to oversee security at drinking water and wastewater facilities.¹⁷ The EPA could require preventive security at water utili-

ties under the general duty clause of the Clean Air Act. The Bush administration, however, blocked a specific proposal developed by EPA and the then Office of Homeland Security (now DHS) to use this authority to establish federal chemical security standards.¹⁸

Less Hazardous Alternatives Are Available

In 2006 the National Research Council reported that “the most desirable solution to preventing chemical releases is to reduce or eliminate the hazard where possible,” including by modifying processes or replacing hazardous materials with less hazardous substitutes.¹⁹ Two years ago, the Center for American Progress recommended an action plan for safeguarding hazardous chemical facilities using these techniques,²⁰ and one year ago released survey findings that documented some 284 facilities across diverse industries that had switched to less acutely hazardous options.²¹

The Association of American Railroads supports development of less hazardous products and technologies as substitutes for highly hazardous materials. In congressional testimony, the association explained that chlorine gas and other “toxic inhalation hazard,” or TIH, chemicals comprise just 0.3 percent of all rail shipments, but railroads face potentially ruinous liability from hauling these chemicals (which they are required to carry). For this reason, the railroads “strongly support efforts aimed at finding and utilizing ‘inherently safer technologies’ as substitutes for hazardous materials, especially TIH” that are shipped by rail.²²

Roughly two-thirds of large U.S. wastewater utilities already use a disinfectant chemical other than chlorine gas, or

plan to stop using chlorine gas.²³ At least 160 large U.S. public drinking water systems already use liquid bleach.²⁴ In last year's survey, the Center for American Progress identified more than 200 drinking water or wastewater facilities that had eliminated chlorine gas since 1999—a sample of similar changes at many water utilities nationwide.²⁵ Most of these water facilities switched to liquid bleach, while others use ultraviolet light.

Last year's report noted that approximately 1,700 drinking water plants and 1,150 wastewater facilities report extremely hazardous substances, primarily chlorine gas, under EPA's Risk Management Planning program. This year's survey report focuses on just those water utilities that recently have received chlorine gas by rail.

Utilities that eliminate chlorine gas may replace other hazardous chemicals. Some wastewater facilities remove chlorine from effluent by using anhydrous sulfur dioxide, a dangerous toxic gas. These facilities frequently replace anhydrous sulfur dioxide with less hazardous sodium

bisulfite. Similarly, some drinking water facilities replace anhydrous ammonia, a toxic gas, with aqueous ammonia, a less hazardous alternative.

Replacement Chemicals Can Be More Safely Produced

Water utilities can buy concentrated bleach in bulk as sodium hypochlorite, or generate dilute bleach on-site from salt and electricity. Recent high prices for chlorine make on-site generation increasingly attractive even for larger water utilities. Several facilities surveyed in this report are considering or adopting on-site bleach, while others are considering or adopting ultraviolet light. Both options eliminate bulk transportation of extremely hazardous substances and greatly reduce overall transportation needs.

In our survey for this report, we found many utilities that eliminated chlorine gas now buy bulk sodium hypochlorite bleach. One argument against converting water utilities to bleach is that it simply shifts the danger to bleach manufacturing facilities,



A freight train derailed on Jan. 6, 2005, in Graniteville, S.C., rupturing a railcar of chlorine gas. The leaking gas visible in the photo above killed nine people, sent 500 to the hospital with breathing problems, and caused more than 5,000 to evacuate for several days. (U.S. EPA)

"We are very glad the chlorine gas is gone. It's an achievement. It used to be our number one employee concern."

*Ray Flasco,
Water Supply
Division Manager,
Akron Water
Supply Plant,
Kent, Ohio*

which typically make hypochlorite from bulk rail shipments of chlorine gas. Producers, however, can manufacture hypochlorite using "just-in-time" technology, in which chlorine gas is created and promptly used only in small amounts, eliminating the danger of a catastrophic gas release.

This process is used in Asia, Australia, Europe, and a few U.S. locations.²⁶ Further industrial-scale production is under development in the United States.²⁷ Currently, some 94 manufacturers across the country produce sodium hypochlorite for use in industrial or household products.²⁸ Full conversion to producing hypochlorite without bulk chlorine gas would eliminate thousands of rail shipments each year and take millions of Americans out of harms way.

Producing hypochlorite bleach from bulk chlorine gas is currently marginally cheaper than using safer and more secure methods—but only insofar as companies do not pay the full costs of security and liability insurance for a potential catastrophic chlorine release. Requiring producers that use bulk chlorine gas to internalize these costs would immediately make large-scale production using safer and more secure methods cost-competitive.

Major Survey Findings

Few Water Utilities Still Use Chlorine Gas Railcars

Only 24 drinking water and 13 wastewater facilities still use *rail shipments* of chlorine gas. Yet because of these few facilities, thousands of tons of deadly chlorine gas pass through major American cities. Some 25 million Americans live within range of a worst-case toxic gas release

around these facilities, and millions more live along rail delivery routes. Among these 37 facilities are:

- St. Paul Regional Water Services-McCarron, Maplewood, Minn., 1.3 million people at risk
- Kansas City, Missouri Water Treatment Plant, 720,000 people at risk
- Omohundro Water Treatment Plant, Nashville, Tenn., 973,663 people at risk
- East Bank Wastewater Treatment Plant, New Orleans, La., 726,185 people at risk*
- Central Regional Wastewater System, Grand Prairie (Dallas), Texas, 3.9 million people at risk

For a complete list see Appendix A on page 16 and the map on page 11.

Many Water Utilities Have Switched to Safer, More Secure Alternatives

At least six drinking water and 19 wastewater facilities have eliminated *rail shipments* of chlorine gas by switching to a less hazardous disinfectant since 1999. As a result, more than 26 million people no longer live within range of a chlorine gas release from these facilities, and additional millions are no longer in danger from rail shipments to these facilities. Among these 25 facilities are:

- Wyandotte Wastewater Treatment Facility, Wyandotte, Mich., 1.1 million people no longer at risk
- Baldwin Water Treatment Plant, Cleveland, Ohio, 1.4 million people no longer at risk

* Population before hurricane Katrina. Facility intends to convert to liquid bleach but lacks dedicated funding amid extensive post-Katrina needs.

- Metropolitan Wastewater Treatment Plant, St. Paul, Minn., 520,000 people no longer at risk
- Joint Water Pollution Control Plant, Carson, Calif. (Los Angeles County), 210,000 people no longer at risk
- White River Water Treatment Plant, Indianapolis, Ind., 968,579 people no longer at risk

For a complete list see Appendix B on page 18 and the map on page 11. Additional water utilities eliminated chlorine gas rail shipments prior to 1999.²⁹

Some Additional Water Utilities Are Eliminating Chlorine Gas

Of the 37 water facilities that still use chlorine railcars, at least four drinking water and two wastewater plants are currently converting to a safer, more secure disinfectant with at least partial construction planned by 2008. Completing these conversions will cut chemical hazards for five million people who live nearby and many others along freight railways. Facilities with well-developed plans to convert include:

- Metro Wastewater Reclamation District, Denver, Colo., 925,000 people at risk
- City of Richmond Water Purification Plant, Richmond, Va., 704,630 people at risk
- Carrollton Water Purification Plant, New Orleans, La., 892,320 people at risk**

Several other facilities may convert within a few years, and others are evaluating alternatives. Two other facilities (in Stockton and San Jose, Calif.) occasionally use liquid bleach as an available backup, but are evaluating more serviceable long-term solutions such as ultraviolet light.

Chlorine Gas Railcars Travel Over Long Distances

Each year, approximately 45,000 shipments of chlorine gas travel by rail in the United States. These shipments may travel over more than 300,000 miles of freight railways across the country.³⁰ Rail lines pass through almost all major American cities and towns.

The 16 chlorine production sites listed in Appendix C reportedly sell chlorine by rail to water utilities through the merchant market. Usually, a distributor company moves the chlorine gas from the original manufacturer to the water utility. These rail shipments may travel long distances—hundreds or even thousands of miles—passing through densely populated cities and towns. There is no legal requirement to use the closest supplier or the safest route.

The large water utilities covered by this report account for only a small portion of the chlorine on the rails—but are by their nature located in or near large cities or towns. Producers also ship to chlorine packaging locations and sodium hypochlorite bleach production facilities. Additional destinations include PVC plastics producers, some paper mills, and chemical manufacturers. Roughly two-thirds of chlorine is never shipped, but rather is used on-site in chemical manufacturing or is moved by pipeline to nearby facilities. For this very reason, chemical manufacturers may collocate to avoid shipping chlorine gas.³¹

The profusion of freight rail lines precludes identifying specific routes between producers and water utilities. However, the map on page 11 illustrates the long distances that rail shipments must travel between manufacturers and the few water utilities that still receive chlorine gas by rail.

“As a plant operator it’s a weight off your shoulders if you don’t have that risk of chlorine gas.”

Nick Frankos,
Plant Manager,
Back River
Wastewater Plant,
Baltimore, Md.

** Population before hurricane Katrina.

Utilities Cited a Number of Reasons for Switching

Personnel at water facilities that eliminated chlorine gas were generally relieved to be rid of it and considered the change an achievement. Reasons and advantages for switching included: improving safety and security; meeting discharge requirements; reducing liability exposure; cutting costs of preventive maintenance, training, emergency planning, and regulatory compliance; mitigating on-site security costs associated with chlorine gas; and previous experience with chlorine leaks.

Most surveyed facilities that have not converted are evaluating disinfectant options. These facilities cited as potential obstacles: costs of capital and replacement chemicals; the large size of the utility and needed chemical volumes; storage space and shelf life of liquid bleach; requirements to maintain backup disinfection capability; and the need for reliable information on alternatives.

Some facilities also noted investments in chlorine-gas security, such as containment buildings, sensors, and scrubbers. Such sunk costs may create a disincentive to further change yet do nothing to protect incoming rail shipments.

Conversion Costs Are Manageable

Twenty facilities provided general information on the construction and operating costs of converting off chlorine gas railcars. Switching these facilities to a safer, more secure disinfectant is affordable, costing no more than \$1.50 per year per person served—the price of a bag of potato chips—even without accounting for important cost savings. Many facilities are spending well less than that amount.

Examples are described in the box on pages 12–13.

Cost figures varied widely depending on facilities' specific circumstances and the information available to respondents. Some facilities, for example, needed to upgrade aging infrastructure; others did not. While many respondents were able to estimate construction and chemical costs, most found it difficult to compile information on *avoided* costs from readily available sources. Some facilities, however, identified important savings in preventive maintenance, emergency planning, employee training, regulatory compliance, future site security, or other factors.

Facilities using chlorine gas face new demands to upgrade physical security to protect against a possible terrorist attack. Current practices include at best such meager physical security measures as better fences, vehicle gates, lights, employee identification, and cameras. Some facilities may also have enclosures and gas scrubbers that attempt to contain an emergency release. Converting from chlorine gas mitigates these costs while providing superior protection to employees and surrounding populations.

After all, there is little reason to believe that current security practices would be able to withstand a well-executed attack by an armed intruder. Nor does enhanced physical security do anything to protect railcars in transit to the facility.

The Government Accountability Office is currently conducting a review of costs associated with conversion of water utilities to less hazardous chemicals. This GAO report is expected in spring 2007.

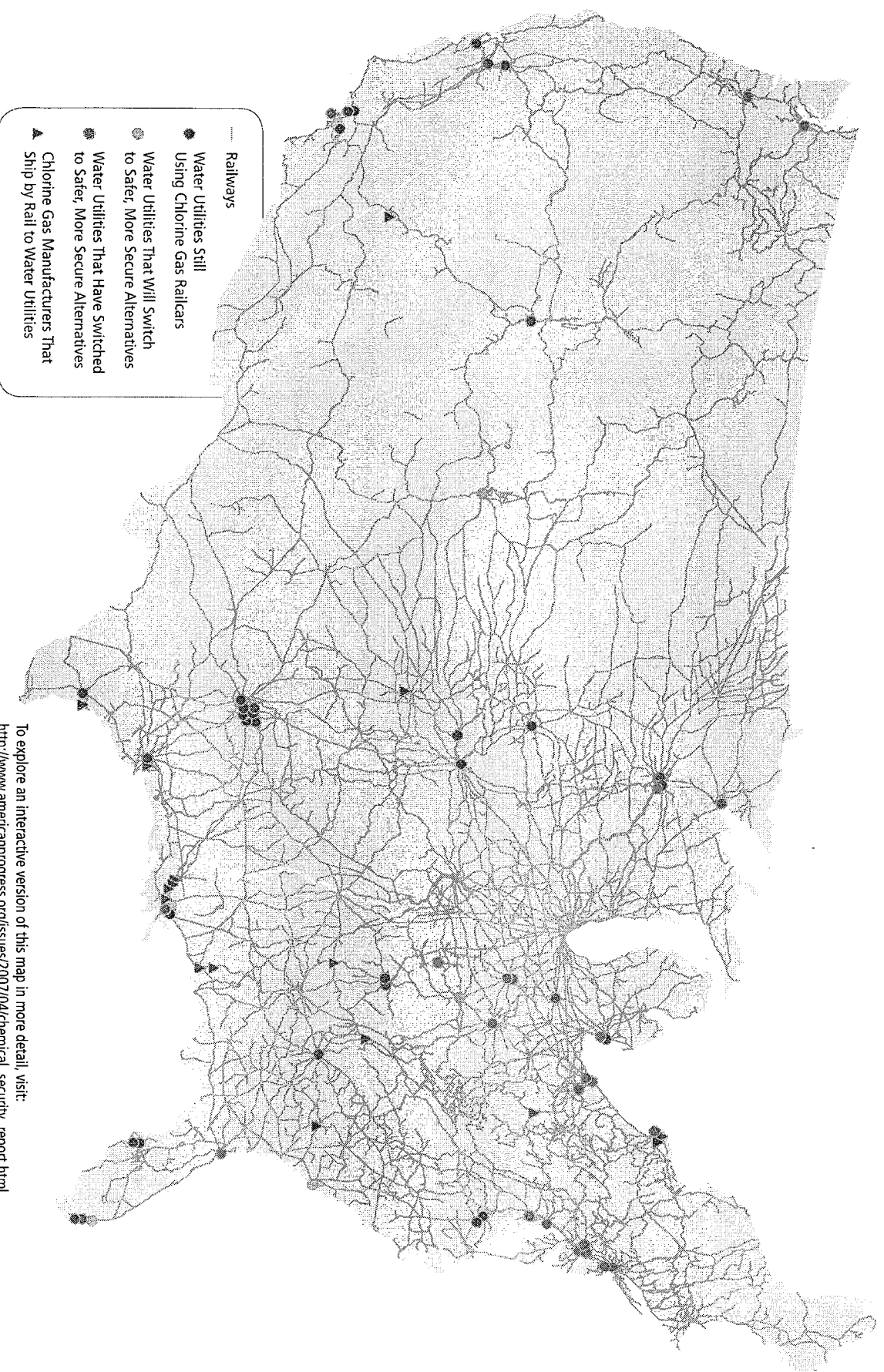
“Maintenance cost... priceless! No special training or emergency repair kits to keep on hand. We do all our repairs in-house where chlorine required an outside contractor. The Fire Department loves us. No more emergency drills and training.”

*John Garvin,
Operation and
Maintenance
Manager,
Regional Water
Resource Agency,
Owensboro, Ky.*

Unnecessary Rail Shipments of Chlorine Gas Endanger Millions

Shown are 37 water utilities that still receive chlorine gas by rail. Distributors ship railcars of chlorine gas from 16 manufacturers to these utilities—frequently over long distances and through densely populated areas. Also shown are 25 water utilities that since 1999 have eliminated railcar shipments of chlorine gas by converting to safer, more secure alternatives for water treatment. Millions of people along railroads are no longer endangered by chlorine gas shipments to these utilities. Of utilities that still receive chlorine gas by rail, at least six more have firm plans to convert from chlorine gas within two years.

11



To explore an interactive version of this map in more detail, visit:
http://www.americanprogress.org/issues/2007/04/chemical_security_report.html

CONVERSION COSTS AT SPECIFIC FACILITIES

These 20 water utilities were able to convert from chlorine gas railcars to effective alternatives at a reasonable cost.³² A single day's expenditures on the war in Iraq could have easily paid for all these conversions.

- **The Metropolitan Wastewater Treatment Plant in St. Paul, Minn.,** switched from chlorine gas railcars to liquid bleach in late 2005. The aging plant required upgrades that were projected to cost about the same whether staying with chlorine gas or switching to liquid bleach. Actual construction cost \$7.8 million, and chemical costs increased \$85,000 per year. Annual operating costs of preventive maintenance, energy, and emergency preparedness decreased about \$65,000, while in-plant security decreased an estimated \$35,000. The entire metropolitan wastewater system serves about 2.4 million people; annual conversion costs, including otherwise necessary construction, are about 20 cents per person served.
- **The Columbia Boulevard Wastewater Treatment Plant in Portland, Ore.,** switched from chlorine gas railcars to liquid bleach in 2005. Construction cost \$4.4 million, and increased chemical costs are more than offset by operating savings anticipated from reduced need for maintenance, electric power, training, labor, and emergency planning. The facility serves some 550,000 people, who will benefit from the offset of operating costs in the long term.
- **The Akron Water Supply Plant in Kent, Ohio,** switched from chlorine gas railcars to liquid bleach in 2004. Construction cost about \$1.1 million (or one-fourth the cost of a new chemical building) and operating costs increased about \$65,000 per year, primarily to cover chemicals. The facility, however, avoided over \$1.2 million in construction costs by eliminating chlorine gas. By switching, the facility avoided constructing a containment building to enclose railcars (\$308,000), installing an emergency gas scrubber (\$598,000), and upgrading certain process equipment such as a chlorine gas evaporator (\$369,000). Even without considering avoided costs, the facility's 280,000 customers pay only approximately 50 cents more each year.
- **The Edward P. Decher Secondary Wastewater Plant in Elizabeth, N.J.,** switched from chlorine gas to liquid bleach in 2003. Construction upgrades cost \$750,000 and chemical costs increased \$291,000 from 2002 to 2004, while maintenance and training costs decreased an estimated \$70,000 per year. The facility serves about 500,000 people; annual conversion costs are about 55 cents per person served.
- **The South Treatment Plant in Renton, Wash.,** switched from chlorine gas to liquid bleach in 2003. Construction cost \$2.4 million, and chemical costs increased about \$350,000 per year. The entire wastewater system serves about 1.4 million people; without accounting for any operating savings, annual conversion costs are less than 40 cents per person served.
- **The Western Lake Superior Sanitary District in Duluth, Minn.,** switched from chlorine gas to liquid bleach in 2006. Construction cost \$1.6 million. Operating costs initially remained about the same, with increased chemical costs offset by decreased demurrage charges that resulted from keeping a chlorine railcar on-site. A newly revised discharge permit will likely lengthen the disinfection season and increase chemical costs in the future. The facility serves 110,000 people; annual conversion costs are thus far about a dollar per person served.
- **Crescent Hill Water Treatment Plant in Louisville, Ky.,** is building an on-site generating facility for bleach disinfectant at an estimated capital cost of roughly \$10 million. Accounting for depreciation, the facility estimates the cost of switching over from chlorine gas at about \$500,000 annually. The entire water system serves about 850,000 people; estimated annual conversion costs are about 60 cents per person served.
- **The City of Richmond Water Purification Plant in Richmond, Va.,** is switching from chlorine gas railcars to liquid bleach in early 2007. Construction cost \$11 million for a new building, about one-third directly linked to storage of liquid bleach. Chemical costs are anticipated to increase \$450,000 per year. The facility serves about 500,000 people;

without accounting for any operating savings, annual conversion costs are about \$1.50 per person served.

- **Blue Plains Sewage Treatment Plant in Washington, D.C.**, switched from chlorine gas railcars to liquid bleach immediately after September 11, 2001. According to the plant's chief engineer at the time, the change adds about 25 cents per month to the average household customer's utility bill.³³
- **The Nottingham and Baldwin drinking water treatment plants in Cleveland, Ohio** completed conversion from chlorine gas to liquid bleach in late 2002 and 2005, respectively. Construction cost an estimated \$2,475,000 for both plants, and chemical costs increased about \$208,000 per year. The Cleveland division of water serves some 1.5 million people; without accounting for any operating savings, annual conversion costs are less than 25 cents per person served.
- **The Buckman Water Reclamation Facility in Jacksonville, Fla.**, switched from chlorine gas railcars to ultraviolet light in 2001. Construction cost \$6 million, including about \$1 million for unrelated upgrades. Electricity costs increased about \$150,000 per year over the previous cost of chlorine gas, but only if not considering recent dramatic chlorine price increases. The entire wastewater system serves about 575,000 people; annual conversion costs are about 80 cents per person served.
- **The Wyandotte Wastewater Treatment Facility in Wyandotte, Mich.**, switched from chlorine gas railcars to ultraviolet light in 2000. Construction cost \$8 million, and operating costs increased from about \$320,000 to \$350,000 each year. The wastewater system serves about 415,000 people; annual conversion costs are about \$1.30 per person served.
- **The Mill Creek Wastewater Treatment Plant in Cincinnati, Ohio**, switched from chlorine gas railcars to liquid bleach in 2001. Constructing a temporary conversion cost less than \$40,000; planned permanent construction is projected to cost less than \$3 million. Chemical costs increased about \$290,000 per year. The entire metropolitan sewer district serves about 800,000 people; without

accounting for any operating savings, annual conversion costs are about 60 cents per person served.

- **The City of Philadelphia** converted its Northeast, Southeast, and Southwest water pollution control plants from chlorine gas to liquid bleach. Capital costs for conversion were \$5.9 million for all three plants, and chemical costs increased about \$275,000 per year. After converting to liquid bleach, these facilities jointly save roughly \$75,000 each year in reduced labor and risk management planning costs. The entire wastewater system serves about 2.2 million people; annual conversion costs are about 25 cents per person served.
- **Samuel S. Baxter Water Treatment Plant in Philadelphia, Pa.**, converted to liquid bleach in 2005. Construction costs were about \$2 million, and chemical costs increased about \$670,000 in 2006. Estimated savings on labor and emergency planning are at least \$25,000 per year. The entire drinking water system serves about 1.6 million people; annual conversion costs are less than 50 cents per person served.
- **The Middlesex County Utilities Authority wastewater plant in Sayreville, N.J.**, switched from chlorine gas railcars to liquid bleach in 2001. Construction cost \$1.3 million, and chemical costs increased from 2002 to 2006 about \$1.5 million, as chlorine prices more than tripled. The wastewater system serves some 800,000 people. Discounting two-thirds of increased chemical costs for price change, and not accounting for any operating savings, annual conversion costs are still less than a dollar per person served.
- **The Back River Wastewater Treatment Facility in Baltimore, Md.**, switched from chlorine gas railcars to liquid bleach in 2004. Construction cost \$2.6 million, and chemical costs increased from 2003 to 2008 about \$2.4 million, during which time chlorine prices more than doubled. For this and other reasons the facility is planning further conversion to generating bleach on-site. The entire wastewater system serves 1.3 million people. Discounting one-half of increased chemical costs for price change, and not accounting for any operating savings, annual conversion costs are still less than a dollar per person served.

Conclusion and Recommendations

More than five years after 9/11 and despite many credible warnings, the U.S. government has yet to enact policies that seriously reduce unnecessary chemical hazards. The Center for American Progress surveyed water utilities that still use chlorine gas railcars to examine systematic shortcomings in current federal chemical security policies, and to encourage Congress to enact policies that swiftly and efficiently remove unnecessary chemical hazards.

The survey shows that many large water utilities have converted from chlorine gas railcars to safer and more secure alternatives. These conversions remove terrorist targets at the facilities and on the rails, and make millions of Americans safer and more secure. Facility operators are relieved when the gas is gone and often proud of helping to bring about the change.

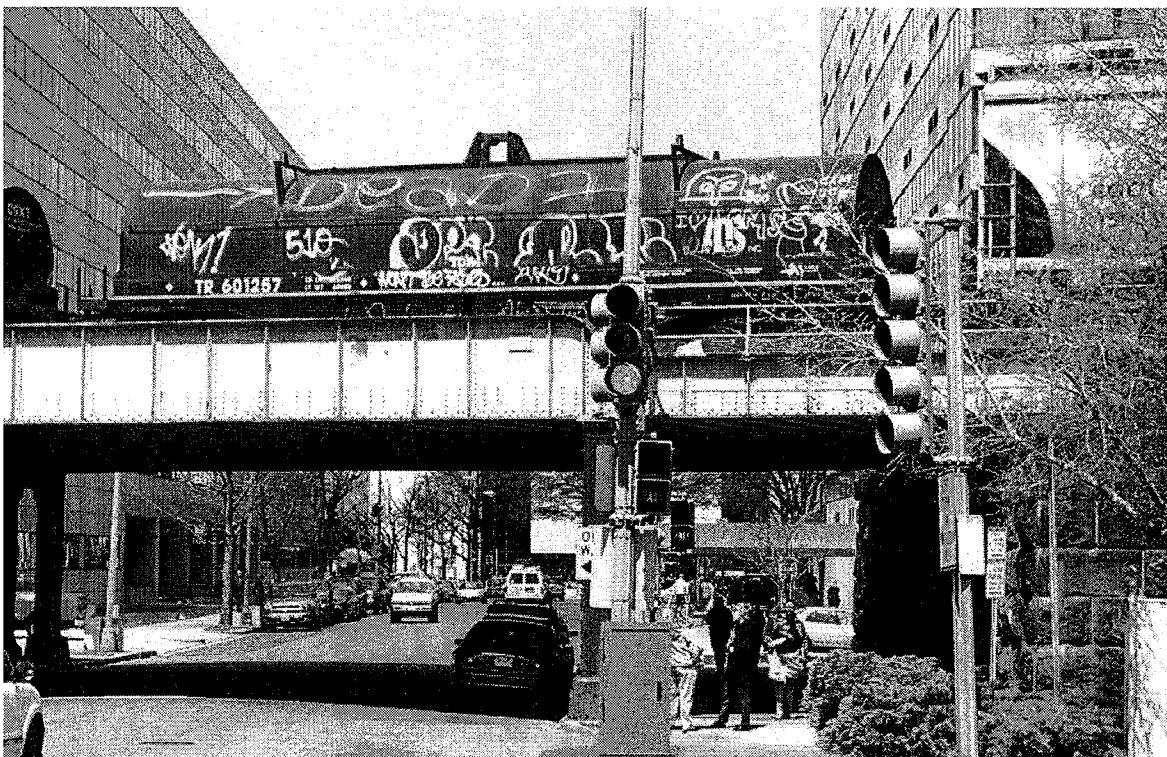
The roughly three dozen water utilities that still receive chlorine gas railcars can also convert to safer alternatives, but many are not acting. At the same time, recently enacted interim chemical security legislation exempts water utilities, neglects transportation hazards, and ignores safer technologies. Millions of Americans remain unnecessarily at risk from a catastrophic chemical release.

To address this threat, Congress, the administration, and industry must make chemical security an urgent national priority, with the goal of transitioning to safer, more secure technologies. Specifically:

- Water utilities that still use railcars of chlorine gas or anhydrous sulfur dioxide should shift to safer and more secure treatment alternatives.
- Congress should require chemical facilities to review and use available, cost-effective technologies that significantly reduce or eliminate serious emergency chemical release hazards.
- Congress should target grants, loans, and other incentives to help water utilities convert from chlorine gas, including facilities that discontinued chlorine gas after September 11, 2001. Such assistance should not cover containment buildings and other physical security measures that are inherently incapable of protecting chlorine gas railcars at water utilities and in transit.

- The Department of Homeland Security should go back to Congress for full authority to safeguard chemical infrastructure and the public, with appropriate roles for other governmental agencies.
- Congress should require chemical facilities to account for transportation risks—including the possibility of a catastrophic chemical release—in developing security alternatives, assessments, and plans.
- Congress should require chemical facilities to involve appropriate employees when developing security alternatives, assessments, and plans.
- The Department of Homeland Security should develop methodologies to account for the impact of safer, more secure technologies on facility security, including the costs, avoided costs, and feasibility of alternatives.
- Manufacturers of liquid bleach should adopt production methods that do not require bulk transportation or storage of chlorine gas. Congress should require these facilities to carry sufficient liability insurance to cover a catastrophic chemical release.

These policy recommendations are reasonable and obtainable. They would impose only insignificant burdens on consumers, while delivering measurable improvements in safety and security. Indeed, many water utilities have already abandoned chlorine gas at affordable cost with effective results. Congress and the Department of Homeland Security have the responsibility to compel the swift conversion of the remaining water utilities that still receive chlorine gas by rail. The reasons to do so are self-evident in this report. Congress and DHS need only act.



A graffiti-covered rail tanker passes within blocks of the National Mall in Washington, D.C. (Jim Dougherty/Sierra Club)

Appendix A

WATER UTILITIES USING CHLORINE GAS RAILCARS

FACILITY NAME	CITY	STATE	FACILITY TYPE	APPROXIMATE FACILITY SIZE— MILLION GALLONS PER DAY (MGD)	CONVERSION STATUS	VULNERABILITY ZONE POPULATION*
Joseph Jensen Filtration Plant	Granada Hills	CA	Drinking water plant	750 MGD	Evaluating alternatives; no active plans to convert	1,700,000
F. E. Weymouth Water Treatment Plant	La Verne	CA	Drinking water plant	520 MGD	Evaluating alternatives; no active plans to convert	304,873
Los Angeles Aqueduct Filtration Plant	Sylmar	CA	Drinking water plant	600 MGD	Have looked at alternatives; no change forecast	290,000
Sacramento Regional Wastewater Treatment Plant	Elk Grove	CA	Wastewater plant	165 MGD	No apparent plans to convert	18,000**
San Jose/Santa Clara Water Pollution Control Plant	San Jose	CA	Wastewater plant	115 MGD	Evaluating alternatives including ultraviolet light; liquid bleach is available backup	245,000
City of Stockton Tertiary Treatment Plant	Stockton	CA	Wastewater plant	35 MGD	Occasionally using liquid bleach as backup; considering other alternatives including ultraviolet light	430,200
Metro Wastewater Reclamation District	Denver	CO	Wastewater plant	160 MGD	Switching to liquid bleach by end of 2007	925,000
Fiveash Water Treatment Plant	Fort Lauderdale	FL	Drinking water plant	70 MGD	Switching to generating bleach on-site or other alternative by about 2008	1,526,000
John E. Preston Water Treatment Plant	Hialeah	FL	Drinking water plant	86 MGD	Developing plans to convert, possibly to on-site bleach; conversion likely within a few years	1,893,169
Alexander Orr Water Treatment Plant	Miami	FL	Drinking water plant	175 MGD	Developing plans to convert, possibly to on-site bleach; conversion likely within a few years	1,643,691
Hillsborough River Water Treatment Plant-Tampa, FL	Tampa	FL	Drinking water plant	85 MGD	Alternatives under consideration; conversion not imminent or planned	508,760
City of Tampa-Howard F. Curren AWTP	Tampa	FL	Wastewater plant	96 MGD	Has studied feasibility; no specific plans to convert	1,042,000
Topeka Water Treatment Plant	Topeka	KS	Drinking water plant	22 MGD	No plans to convert	173,925
Crescent Hill Water Treatment Plant	Louisville	KY	Drinking water plant	100 MGD	Switching to generating bleach on-site by about 2008-2009	675,100
Carrollton Water Purification Plant	New Orleans	LA	Drinking water plant	120 MGD	Switching to liquid bleach, likely in 2007	892,320
East Bank Wastewater Treatment Plant	New Orleans	LA	Wastewater plant	108 MGD (pre-Katrina)	Planning to convert eventually; timeline uncertain given major capital needs post-Katrina	726,185
Detroit WWTP-Chlorination/Dechlorination Facility	Detroit	MI	Wastewater plant	700 MGD	No plans to convert	2,100,000

* Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.

** This figure most likely significantly understates the facility's vulnerability zone population.

Appendix A, continued

WATER UTILITIES USING CHLORINE GAS RAILCARS, CONTINUED

FACILITY NAME	CITY	STATE	FACILITY TYPE	APPROXIMATE FACILITY SIZE— MILLION GALLONS PER DAY (MGD)	CONVERSION STATUS	VULNERABILITY ZONE POPULATION*
St. Paul Regional Water Services-McCarron	Maplewood	MN	Drinking water plant	50 MGD	No plans to convert	1,300,000
Fridley Filter Plant	Minneapolis	MN	Drinking water plant	85 MGD	No plans to convert	337,000
Kansas City, Missouri Water Treatment Plant	Kansas City	MO	Drinking water plant	115 MGD	No plans to convert	720,000
Florence Water Treatment Plant	Omaha	NE	Drinking water plant	64 MGD	No plans to convert	390,000
North Charleston Sewer District WWTP Herbert Site	Charleston	SC	Wastewater plant	17 MGD	Switching to ultraviolet light, expected completion about summer 2007	365,213
Omohundro Water Treatment Plant	Nashville	TN	Drinking water plant	90 MGD	Evaluating options; no finalized plan to convert	973,663
Central Wastewater Treatment Plant	Nashville	TN	Wastewater plant	288 MGD	Evaluating options; no finalized plan to convert	965,468
O.N. Stevens Water Treatment Plant	Corpus Christi	TX	Drinking water plant	80 MGD	No plans to convert	360,000
Elm Fork Water Treatment Plant	Carrollton	TX	Drinking water plant	330 MGD	Evaluating alternatives; no specific plan to convert	790,000
Bachman Water Treatment Plant	Dallas	TX	Drinking water plant	150 MGD	Evaluating alternatives; no specific plan to convert	2,000,000
Eastside Water Treatment Plant	Sunnyvale	TX	Drinking water plant	440 MGD	Evaluating alternatives; no specific plan to convert	1,800,000
NTMWD Regional Water Treatment Plant	Wylie	TX	Drinking water plant	265 MGD	No plans to convert; evaluating options	137,517
Central Wastewater Treatment Plant	Dallas	TX	Wastewater plant	120 MGD	No plans to convert; preliminary cost analysis of alternatives	930,000
Central Regional Wastewater System	Grand Prairie	TX	Wastewater plant	150 MGD	No plans to convert	3,931,692
Rolling Hills Water Treatment Plant	Fort Worth	TX	Drinking water plant	100 MGD	Under review; investigating on-site generation of bleach	428,447
East Water Purification Plant	Houston	TX	Drinking water plant	225 MGD	No plans to convert; alternatives evaluation ongoing	1,300,000
Central Valley Water Reclamation Facility	Salt Lake City	UT	Wastewater plant	56 MGD	Evaluating options as part of facility upgrade	1,334,000
Hopewell Water Treatment Plant	Hopewell	VA	Drinking water plant	10 MGD	Currently under review; no apparent plans to convert	91,000
City of Richmond Water Purification Plant	Richmond	VA	Drinking water plant	132 MGD	Switching to liquid bleach; completing conversion early 2007	704,630
City of Richmond Wastewater Treatment Plant	Richmond	VA	Wastewater plant	60 MGD	Evaluating and testing alternatives; no clear timeline to convert	722,769

* Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.

Appendix B

WATER UTILITIES NO LONGER USING CHLORINE GAS RAILCARS*

FACILITY NAME	CITY	STATE	FACILITY TYPE	APPROXIMATE FACILITY SIZE— MILLION GALLONS PER DAY (MGD)	CONVERSION STATUS	CONVERSION YEAR	FORMER VULNERABILITY ZONE POPULATION**
Joint Water Pollution Control Plant	Carson	CA	Wastewater plant	330 MGD	Switched to liquid bleach	2004	210,000
Blue Plains Wastewater Treatment Plant	Washington	DC	Wastewater plant	370 MGD	Switched to liquid bleach	2001	1,700,000
Buckman Water Reclamation Facility	Jacksonville	FL	Wastewater plant	41 MGD	Switched to ultraviolet light	2001	360,000
R. M. Clayton WRC	Atlanta	GA	Wastewater plant	80 MGD	Switched to ultraviolet light	2000	1,151,993
Fall Creek Water Treatment Plant	Indianapolis	IN	Drinking water plant	20 MGD	Switched to liquid bleach	2000	771,633
White River Water Treatment Plant	Indianapolis	IN	Drinking water plant	70 MGD	Switched to liquid bleach	2003	968,579
Water Pollution Control Plant	Fort Wayne	IN	Wastewater plant	50 MGD	Switched to liquid bleach	2006	330,000
Waste Water Treatment Plant, West	Owensboro	KY	Wastewater plant	8 MGD	Switched to liquid bleach	2001	90,000
Jefferson Parish East Bank WWTP	Harahan	LA	Wastewater plant	40 MGD (pre-Katrina)	Switched to liquid bleach	2003	790,000
Back River Wastewater Treatment Facility	Baltimore	MD	Wastewater plant	150 MGD	Switched to liquid bleach	2004	1,470,000
Wyandotte Wastewater Treatment Facility	Wyandotte	MI	Wastewater plant	45 MGD	Switched to ultraviolet light	2000	1,100,000
Metropolitan Wastewater Treatment Plant	St. Paul	MN	Wastewater plant	222 MGD	Switched to liquid bleach	2005	520,000
Western Lake Superior Sanitary District	Duluth	MN	Wastewater plant	43 MGD	Switched to liquid bleach	2006	128,293
Middlesex County Utilities Authority	Sayreville	NJ	Wastewater plant	120 MGD	Switched to liquid bleach	2001	10,740,000
Edward P. Decher Secondary Wastewater Trmt. Plant	Elizabeth	NJ	Wastewater plant	65 MGD	Switched to liquid bleach	2003	50,000
City of Niagara Falls Wastewater Treatment Plant	Niagara Falls	NY	Wastewater plant	32 MGD	Switched to liquid bleach	2003	1,100,000
Mill Creek WWTP	Cincinnati	OH	Wastewater plant	130 MGD	Switched to liquid bleach	2001	860,000
Nottingham Water Treatment Plant	Cleveland	OH	Drinking water plant	70 MGD	Switched to liquid bleach	2002	1,100,000
Baldwin Water Treatment Plant	Cleveland	OH	Drinking water plant	60 MGD	Switched to liquid bleach	2005	1,400,000
Akron Water Supply Plant	Kent	OH	Drinking water plant	38 MGD	Switched to liquid bleach	2004	411,356
Columbia Boulevard Wastewater Treatment Plant	Portland	OR	Wastewater plant	70 MGD	Switched to liquid bleach	2005	157,500
Southeast Water Pollution Control Plant	Philadelphia	PA	Wastewater plant	90 MGD	Switched to liquid bleach	2002	1,182,741
Northeast Water Pollution Control Plant	Philadelphia	PA	Wastewater plant	190 MGD	Switched to liquid bleach	2003	1,575,971
Samuel S. Baxter Water Treatment Plant	Philadelphia	PA	Drinking water plant	165 MGD	Switched to liquid bleach	2005	787,271
South Treatment Plant	Renton	WA	Wastewater plant	80 MGD	Switched to liquid bleach	2003	650,000

* Facility converted since 1999 and fully eliminated chlorine gas.

** Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.

Appendix C

PRODUCERS OF CHLORINE GAS SHIPPED BY RAIL TO WATER UTILITIES

FACILITY NAME	CITY	STATE	FACILITY TYPE	VULNERABILITY ZONE POPULATION*
Olin Corp. McIntosh, Alabama Plant	McIntosh	AL	Chlorine producer	42,750
Occidental Chemical Corporation, Mobile Plant	Mobile	AL	Chlorine producer	334,000
Occidental Chemical Corp., Muscle Shoals Facility	Muscle Shoals	AL	Chlorine producer	115,282
Olin Corporation Augusta, Georgia Plant	Augusta	GA	Chlorine producer	440,000
Occidental Chemical (formerly Vulcan Chemicals)	Wichita	KS	Chlorine producer	500,831
Occidental Chemical Corporation Convent Plant	Convent	LA	Chlorine producer	250,000
Occidental Chemical (formerly Vulcan Chemicals)	Geismar	LA	Chlorine producer	490,000
Occidental Chemical Taft Plant	Hahnville	LA	Chlorine producer	830,000
Pioneer Americas LLC	St. Gabriel	LA	Chlorine producer	408,000
Pioneer Americas LLC	Henderson	NV	Chlorine producer	1,100,000
Olin Corporation-Niagara Falls, New York Plant	Niagara Falls	NY	Chlorine producer	998,200
Occidental Chemical Corporation-Niagara Plant	Niagara Falls	NY	Chlorine producer	1,100,000
Olin Chlor-Alkali, Charleston Plant	Charleston	TN	Chlorine producer	258,000
Occidental Chemical Corporation Ingleside Plant	Gregory	TX	Chlorine producer	362,031
Oxy Vinyls, LP-Battleground Chlor-Alkali Plant	La Porte	TX	Chlorine producer	2,300,000
PPG Industries, Inc., Natrium	New Martinsville	WV	Chlorine producer	97,585

* Vulnerability zone figures, submitted by facilities to EPA, indicate residential populations within range of a worst-case toxic chemical release. These figures are not forecasts of potential casualties.

Appendix D: Methodology

After the Center for American Progress released survey findings last year that documented 284 facilities in diverse industries that have switched to less acutely hazardous chemicals or processes, we decided to conduct a follow-up survey of water utilities that receive rail shipments of chlorine gas. We undertook this survey for four primary reasons. First, 90-ton railcars of chlorine gas pose a distinct danger of a major chemical release. Second, large water utilities are typically located near major cities and thus endanger large numbers of people. Third, rail shipments of chlorine gas travel many miles through populated areas, putting even more people at risk. And finally, there are clear, readily available alternatives to chlorine gas, which means this vulnerability can be quickly addressed.

This survey shows where progress has been made, drawing attention to successful, cost-effective plant conversions, and where we still have security vulnerabilities, giving particular attention to rail vulnerabilities, which are too frequently left out of the chemical-security conversation.

The survey included drinking water or wastewater facilities that reported railcar amounts of chlorine gas under EPA's Risk Management Planning, or RMP, program at some time since the program began in June 1999. Several water utilities that discontinued chlorine gas railcars prior to 1999 were also surveyed. The survey consisted of telephone interviews and in some cases follow-up email communication.

For water utilities that still report chlorine gas in railcar amounts, the survey used unstructured questions about the facility's timeline and plans, if any, to convert to a safer and more secure disinfectant, as well as about facility size, population served, and potential obstacles to conversion. For facilities that had already switched or where conversion is underway, the survey also covered conversion costs. In some cases facility size and population figures are from facility Websites or EPA's Clean Watersheds Needs Survey.³⁴

This survey report uses publicly available rail maps and population density figures to illustrate transportation concerns in shipping chlorine gas from manufacturing sites through distributors to water utilities. Chlorine production sites were identified through industry publications and EPA regulatory analysis documents covering the chlorine industry.³⁵ Given the complexity and variability of suppliers and railways, the survey report does not link suppliers, distributors, and water utilities over specific rail routes.

Acknowledgments

Paul Orum wrote this survey report and interviewed personnel at the facilities it covers. Mr. Orum previously authored “Preventing Toxic Terrorism: How Some Chemical Facilities are Removing Danger to American Communities,” published by the Center for American Progress in April 2006. He is the former director of the Working Group on Community Right-to-Know and currently works as an independent consultant on chemical safety and security issues.

Reece Rushing, director of regulatory and information policy at the Center for American Progress, provided editorial oversight and assisted in preparing the report. P.J. Crowley, senior fellow and director of national defense and homeland security at the Center for American Progress, also provided input and guidance on the report.

The photo on the cover is courtesy of Jim Dougherty/Sierra Club. The author and the Center for American Progress also thank Carol Andress of Environmental Defense for providing helpful comments, and greatly appreciate the cooperation of survey respondents at water utilities across the country.

Endnotes

- 1 Summary population at risk figures used in this report factor in overlapping vulnerability zones.
- 2 Summary water treatment figures used in this report factor in overlapping service areas.
- 3 The survey did not attempt to identify facilities that converted from chlorine gas railcars to a less hazardous disinfectant prior to 1999, but noted several wastewater facilities that had done so—the Southwest Wastewater plant in Philadelphia, Pa., and the Southerly and Westerly plants in Cleveland, Ohio. In addition, the Dalecarlia water plant in Washington, D.C. eliminated chlorine gas railcars in the 1980s and is planning long-term conversion to a less hazardous disinfectant. The survey identified three additional facilities that eliminated rail shipments of chlorine gas since 1999, but that still use smaller containers while planning long-term conversion to a safer and more secure disinfectant—the 23rd Avenue wastewater plant in Phoenix, Ariz., and the Crown water plant and Morgan water plant in Cleveland, Ohio. Other water utilities in Wheeling, W.V., Erie, Pa., and St. Louis, Mo., eliminated chlorine railcars since 1999, but have no current plans to fully convert to a less hazardous disinfectant.
- 4 Two additional wastewater facilities, in San Jose and Stockton, Calif., occasionally use less hazardous liquid bleach as a backup disinfectant.
- 5 These dispersion distances are found in RMP*Comp, developed by the Computer Aided Management of Emergency Operations (CAMEO) team of the National Oceanic and Atmospheric Administration and the U.S. Environmental Protection Agency. The Chlorine Institute, Pamphlet 74, "Estimating the Area Affected by a Chlorine Release" (1998) states that a chlorine gas plume from a railcar can remain at 14.8 miles "immediately dangerous to life or health." This is the level from which a healthy person must escape within 30 minutes or risk irreversible harm or death.
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- 7 U.S. Naval Research Laboratory, Testimony of Dr. Jay Boris before the City Council of the District of Columbia, October 6, 2003.
- 8 U.S. Government Accountability Office, GAO-05-851, Passenger Rail Security: Enhanced Federal Leadership Needed to Prioritize and Guide Security Efforts (September 2005).
- 9 "Militants Using Chemical Bombs in Iraq," *The New York Times*, February 21, 2007.
- 10 International Brotherhood of Teamsters, High Alert: Workers Warn of Security Gaps on Nation's Railroads (Fall 2005).
- 11 Working Group on Community Right-to-Know, Chemical Plant Security Breaches in the News (February 2007).
- 12 "Terror on the Tracks," *Pittsburgh Tribune*, January 14, 2007.
- 13 The National Response Center is the federal point of contact for reporting oil and chemical spills. NRC does not verify spill reports, which may range from very small to large.
- 14 These entities include the Department of Homeland Security, Department of Justice, Government Accountability Office, Environmental Protection Agency, Agency for Toxic Substances and Disease Registry, Army Surgeon General, and Naval Research Laboratory, Brookings Institution, Rand Corporation, PACE International Union, Center for Strategic and International Studies, and numerous investigative news reports.
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- 19 National Research Council, National Academy of Sciences, Terrorism and the Chemical Infrastructure: Protecting People and Reducing Vulnerabilities (May 2006).
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- 21 Paul Orum for the Center for American Progress, Preventing Toxic Terrorism: How Some Chemical Facilities are Removing Danger to American Communities (April 24, 2006).
- 22 Edward R. Hamberger, Association of American Railroads, Statement before the U.S. House of Representatives Committee on Transportation and Infrastructure, Subcommittee on Railroads (June 13, 2006).
- 23 U.S. Government Accountability Office, GAO-06-390, Securing Wastewater Facilities: Utilities Have Made Important Upgrades but Further Improvements to Key System Components May be Limited by Costs and Other Constraints (March 2006).
- 24 Reported disinfection treatments for public water systems serving more than 100,000 people. U.S. Environmental Protection Agency, Safe Drinking Water Information System (January 2007).
- 25 Paul Orum for the Center for American Progress, Preventing Toxic Terrorism: How Some Chemical Facilities are Removing Danger to American Communities (April 24, 2006).
- 26 U.S. producers that can manufacture industrial sodium hypochlorite without bulk transportation or storage of chlorine gas include Odyssey Manufacturing (Tampa, Fla.), BleachTech (Seville, Ohio), and Kuehne Chemical (Delaware City, Del.). A leading manufacturer of equipment to produce sodium hypochlorite without bulk chlorine gas is Powell Fabrication and Manufacturing, marketed as UniChlor Technology.
- 27 KIK Custom Products, letter to the Honorable Ed Markey, Member of Congress (July 26, 2006).
- 28 Chlorine Institute, Pamphlet 10, North American Chlor-Alkali Industry Plants and Production Data Report 2005 (August 2006).
- 29 The survey did not attempt to identify facilities that converted prior to 1999, but noted three additional wastewater facilities that had done so. These facilities are the Southwest Wastewater plant in Philadelphia, Pa., and the Southerly and Westerly plants in Cleveland, Ohio. In addition, the Dalecarlia water plant in Washington, D.C. eliminated chlorine gas railcars in the 1980s and is planning long-term conversion to a less hazardous disinfectant.
- 30 Bill Johnstone for the Center for American Progress, New Strategies to Protect America: Terrorism and Mass Transit After London and Madrid (August 10, 2005).
- 31 "Akzo Takes Chlorine off the Rails; Relocating Output Addresses Transportation Concerns," Ian Young, *Chemical Week*, November 22, 2006.
- 32 Conversion cost information was not available or incomplete from other facilities covered by the survey.
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- 34 Population served and facility flow information from EPA's Clean Watersheds Needs Survey is found at <http://cfpub.epa.gov/cwns/populationP.cfm>.
- 35 U.S. Environmental Protection Agency, Economic Analysis of Air Pollution Regulations: Chlorine Industry (August 2000), and Chlorine Institute, Pamphlet 10, North American Chlor-Alkali Industry Plants and Production Data Report 2005 (August 2006).

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ATTACHMENT 3

United States Government Accountability Office

GAO

Report to the Chairman, Committee on
Environment and Public Works, U.S.
Senate

March 2007

SECURING WASTEWATER FACILITIES

Costs of Vulnerability
Assessments, Risk
Management Plans,
and Alternative
Disinfection Methods
Vary Widely



G A O

Accountability * Integrity * Reliability

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Highlights

Highlights of GAO-07-480, a report to the Chairman, Committee on Environment and Public Works, U.S. Senate

Why GAO Did This Study

Wastewater facilities provide the essential service of collecting and treating wastewater, and discharging treated effluent into receiving waters. Since September 11, 2001, the nation's water infrastructure has received greater attention, including the risk of terrorist attacks at wastewater facilities that store hazardous chlorine gas for disinfection.

In 2006, GAO reported that many large wastewater facilities have responded to this risk by voluntarily conducting vulnerability assessments and converting from chlorine gas to other disinfection methods. The Clean Air Act requires all wastewater facilities that use threshold quantities of chlorine gas to prepare and implement risk management plans to prevent accidental releases and reduce the severity of any releases.

In this study, GAO was asked to provide information on (1) the range of costs large wastewater treatment facilities incurred in preparing vulnerability assessments and risk management plans, and (2) the costs large wastewater treatment facilities incurred in converting from chlorine gas to alternative disinfection processes. To answer these questions, GAO conducted structured telephone interviews with a number of facilities surveyed for the 2006 report. The Environmental Protection Agency (EPA) agreed with the report and provided several technical changes and clarifications.

www.gao.gov/cgi-bin/getrpt?GAO-07-480.

To view the full product, including the scope and methodology, click on the link above. For more information, contact John Stephenson at (202) 512-3841 or stephensonj@gao.gov.

SECURING WASTEWATER FACILITIES

Costs of Vulnerability Assessments, Risk Management Plans, and Alternative Disinfection Methods Vary Widely

What GAO Found

Among the large wastewater facilities GAO examined, the costs reported to prepare vulnerability assessments ranged from \$1,000 to \$175,000, while costs to prepare risk management plans ranged from less than \$1,000 to over \$31,000. Whether the documents were prepared in-house or contracted to third parties such as engineering firms was a factor in cost differences. Despite higher costs, some facilities preferred to use contractors due to their expertise and independence. According to one wastewater security official, these attributes can give contractor findings and recommendations greater credibility with utility governing boards that determine spending priorities. One facility that used a contractor to complete a vulnerability assessment in 2002 did so because, at the time, vulnerability assessment software and training were not widely available. Since that time, EPA has increased funding for the development and dissemination of risk assessment software and related training. Overall, cost estimates for vulnerability assessments and risk management plans did not relate to facility size, as measured by millions of gallons of wastewater treated per day.

For the large wastewater facilities GAO examined, reports of actual and projected capital costs to convert from chlorine gas to alternative disinfection methods range from about \$650,000 to just over \$13 million. Most facilities converted, or planned to convert, to delivered sodium hypochlorite (essentially a concentrated form of household bleach shipped in bulk to the facility). Managers of these facilities told GAO they considered other options, but chose delivered sodium hypochlorite because its capital conversion costs were lower than those associated with other alternatives, such as generating sodium hypochlorite on-site or using ultraviolet light. Overall, the primary factors associated with facilities' conversion costs included the type of alternative disinfection method chosen and the size of the facility. Other cost factors facility managers cited included (1) whether existing buildings and related infrastructure could be used in the conversion, (2) labor and building supply costs, which varied considerably among locations, (3) the cost of sodium hypochlorite relative to chlorine gas, and (4) the extent to which training, labor, and regulatory compliance costs were reduced for utilities that no longer had to rely on chlorine gas.

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Abbreviations

AWWARF	American Water Works Association Research Foundation
DHS	Department of Homeland Security
EPA	Environmental Protection Agency
NACWA	National Association of Clean Water Agencies
OSHA	Occupational Safety and Health Administration
POTW	publicly owned treatment works
RAM-W	Risk Assessment Methodology for Water Utilities
VSAT	Vulnerability Self Assessment Tool
WEF	Water Environment Federation

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United States Government Accountability Office
Washington, DC 20548

March 30, 2007

The Honorable Barbara Boxer
Chairman
Committee on Environment and Public Works
United States Senate

Dear Madam Chairman:

Wastewater facilities in the United States provide essential services to residential, commercial, and industrial users by collecting and treating wastewater and discharging treated effluent into receiving waters. The Centers for Disease Control and Prevention cited sewage disposal and water treatment as important contributors to the control of infectious diseases, which it considers 1 of the 10 greatest achievements in public health of the 20th century. Wastewater disinfection, a key component of the wastewater treatment process, reduces the risk that disease will be transmitted through wastewater effluents. Historically, chlorination has been the most commonly used method of wastewater disinfection because it destroys a variety of pathogens and microorganisms.

Since the events of September 11, 2001, the security of the nation's water infrastructure against terrorist threats has received greater attention, including the potential for terrorist attacks at wastewater facilities that store large amounts of chlorine gas. If released, chlorine gas may threaten utility employees and the public near the affected facilities. The gas can be deadly if inhaled and, at lower doses, can burn the eyes and skin and inflame the lungs. In a 2004 report, the White House Homeland Security Council determined that a terrorist attack on an urban chemical facility that resulted in the rupture of a chlorine gas rail car could kill up to 17,500 individuals and hospitalize as many as 100,000.

While federal law does not require wastewater systems to take security measures to protect specifically against a terrorist attack, it does require certain wastewater facilities to take security precautions that could mitigate the consequences of such an attack. For example, the Clean Air Act¹ requires wastewater facilities that use threshold quantities of certain

¹Pub. L. No. 101-549 (1990).

hazardous substances, such as chlorine gas, to prepare and implement a risk management plan designed to prevent accidental releases of regulated substances and reduce the severity of those releases that do occur.²

As we reported in March 2006,³ many of the nation's large wastewater facilities have improved security since September 11, 2001. For instance, a substantial number of facilities reported improving security fences, increasing security lighting, and implementing improved employee and visitor identification systems, among other security enhancements. In addition, though not required, many large wastewater facilities reported that they conducted vulnerability assessments⁴ to identify risks to key process components such as the use, storage, and handling of chlorine gas. Finally, many facilities reported that they recently stopped or plan to stop using chlorine gas in favor of alternate disinfection methods. Commonly used alternatives include sodium hypochlorite, essentially a concentrated form of household bleach, and ultraviolet light, which breaks down disease-causing microorganisms.

For wastewater facility managers, the costs of preparing vulnerability assessments and risk management plans and converting to alternate disinfection methods must compete for available resources with other infrastructure needs. For instance, in 2003, in its most recent Clean Water Needs Survey, the Environmental Protection Agency (EPA) estimated that, nationwide, wastewater systems faced \$181.2 billion in costs to upgrade treatment systems and sewer lines, reduce the incidences of combined sewer overflows, which result in the discharge of untreated wastewater into receiving waters, and meet other pollution control requirements. Major U.S. cities, including Washington, D.C., and Cincinnati, Ohio, are facing costs between \$1 billion and \$2 billion to implement necessary capital improvements.

²EPA requires that any facility storing at least 2,500 pounds of chlorine gas submit a risk management plan.

³GAO, *Securing Wastewater Facilities: Utilities Have Made Important Upgrades but Further Improvements to Key System Components May Be Limited by Costs and Other Constraints*, GAO-06-390 (Washington, D.C.: Mar. 31, 2006).

⁴According to the Environmental Protection Agency (EPA), vulnerability assessments performed by water sector utilities address not only utility vulnerabilities, but also utility threats and consequences.

This report provides information on (1) the range of costs large wastewater treatment facilities incurred in preparing vulnerability assessments and risk management plans, and (2) the costs large wastewater treatment facilities incurred in converting from chlorine gas to alternative disinfection processes.

To identify the costs of preparing vulnerability assessments and risk management plans, we conducted structured telephone interviews with a select sample of large wastewater facilities identified as having completed these assessments in our March 2006 report.⁵ Our March report identified 106 large facilities that prepared vulnerability assessments or had one underway and 85 facilities that were required to prepare risk management plans because they currently used chlorine gas as a disinfectant. From this universe, we chose a nonprobability sample of facilities based largely on geographic representation and size.⁶

To identify the costs incurred by wastewater treatment facilities in converting from gaseous chlorine to alternative disinfection processes, we conducted structured telephone interviews with most of the 38 large facilities identified in the March report as having converted recently from chlorine gas or indicating that they planned to do so. We also conducted site visits with some of the facilities. Where available, we gathered documentation, such as capital plans, from these facilities in order to document conversion costs. We supplemented the cost information we gathered at individual wastewater facilities with information obtained at EPA, the Department of Homeland Security (DHS), and nongovernmental organizations. Reported costs for preparing vulnerability assessments, risk management plans, and conversion from gaseous chlorine include both actual and estimated costs. For estimated costs, we asked facility managers to explain how they arrived at these estimates. Reported costs were not adjusted for inflation. We determined that reported cost data were sufficiently reliable to provide useful information about the costs for preparing vulnerability assessments, risk management plans, and conversion from gaseous chlorine and the factors that affect these costs. We conducted our work between August 2006 and March 2007 in

⁵We defined large wastewater facilities as those publicly owned treatment works (POTW) that serve residential populations of 100,000 or greater.

⁶Results from nonprobability samples cannot be used to make inferences about a population, because in a nonprobability sample some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample.

accordance with generally accepted government auditing standards. A more detailed discussion of our scope and methodology is included in appendix I.

Results in Brief

The expenses large wastewater facilities reported to prepare vulnerability assessments and risk management plans varied widely among the facilities we interviewed, costing less than \$1,000 in some cases to \$175,000 in others. The cost differences were related to whether the documents were prepared in-house or contracted to third parties such as engineering firms. Despite higher costs, some facilities preferred to use contractors due to their expertise and independence. According to one wastewater security official, these attributes can give contractor findings and recommendations greater credibility with utility governing boards that determine spending priorities. Overall, cost estimates of the facilities we interviewed did not relate to facility size, as measured by millions of gallons of wastewater treated per day.

Large wastewater facilities that converted or plan to convert from chlorine gas disinfection to alternative disinfection processes also report widely varying costs, ranging from about \$650,000 to just over \$13 million. Key factors associated with these costs included the type of alternative disinfection method chosen and the size of the facility. The majority of the facilities we examined converted or plan to convert to sodium hypochlorite (either delivered in bulk to the facility or generated on-site), which has lower capital costs than converting to ultraviolet light. For example, managers of a treatment facility in Virginia told us they spent about \$1.2 million in 2004 converting to bulk sodium hypochlorite disinfection, while managers of a comparably sized facility in Maryland told us they plan to spend an estimated \$4 million converting to ultraviolet light disinfection by the end of this year. Managers of the Maryland facility indicated that one reason they chose the more expensive ultraviolet treatment option over bulk deliveries of sodium hypochlorite was to reduce risk to local traffic that could result from additional deliveries to the plant. In addition, using ultraviolet light eliminates the need for wastewater treatment plants to handle and store significant amounts of hazardous or corrosive chemicals. Other than the disinfection method and facility size, key cost factors wastewater facilities cited included

- (1) whether existing buildings could be used in the conversion,
- (2) building costs, which varied considerably from location to location,
- (3) the higher cost of sodium hypochlorite relative to chlorine gas, and
- (4) the extent to which training, labor, and regulatory compliance costs were lower at plants that no longer had to rely on chlorine gas.

Background

A majority of the nation's wastewater is treated by publicly owned treatment works that serve a variety of customers, including private homes, businesses, hospitals, and industry. These publicly owned treatment works are regulated by the Clean Water Act. Wastewater treatment includes a collection system (the underground network of sewers) and a treatment facility. Wastewater enters the treatment facility through the collection system, where it undergoes an initial stage called primary treatment, during which screens remove coarse solids, and grit chambers and sedimentation tanks allow solids to gradually sink. Next, wastewater enters secondary treatment, where bacteria consume most of the organic matter in the wastewater. After these processes, wastewater is disinfected to eliminate remaining pathogens and other harmful microorganisms.

Wastewater facilities typically use both chemical and physical disinfection methods, including the following:

- *Chlorine gas.* Injecting chlorine gas into a waste stream has been the traditional method of disinfecting wastewater. Chlorine gas is a powerful oxidizing agent, is relatively inexpensive, and can be stored for an extended period of time as a liquefied gas under high pressure. Also, the residual chlorine that remains in the wastewater effluent can prolong disinfection after initial treatment. However, chlorine gas is extremely volatile and hazardous, and it requires specific precautions for its safe transport, storage, and use. Because it is stored and transported as a liquefied gas under pressure, if accidentally released, chlorine gas can quickly turn into a potentially lethal gas. EPA requires, among other things, that any facility storing at least 2,500 pounds of chlorine gas prepare a risk management plan that lays out accident prevention and emergency response activities. At certain concentrations, the residual chlorine that remains in wastewater effluent is toxic to aquatic life, so wastewater facilities that use chlorine compounds may also need to dechlorinate the treatment stream before discharging it to receiving waters.⁷ Chlorine can also oxidize certain types of organic matter in wastewater, creating hazardous chemical byproducts, such as trihalomethanes. Our March 2006 report found that many large wastewater facilities have discontinued, or are planning to discontinue using chlorine gas as a disinfectant in favor of alternative disinfection methods such as sodium

⁷Sulfur dioxide, often used for dechlorination by wastewater facilities, is also covered by risk management plan rules when used or stored in threshold amounts.

hypochlorite delivered in bulk to the facility. Of the 206 large wastewater facilities responding to our survey, only 85 facilities indicated they currently use chlorine gas, and 20 of these facilities plan to switch from the gas to another disinfectant.

- *Sodium hypochlorite.* Injecting sodium hypochlorite—essentially a concentrated form of household bleach—into a waste stream is another chlorination method of disinfecting wastewater. Sodium hypochlorite is safer than chlorine gas because, if spilled, it remains liquid and can be contained and recovered. For this reason, it is not subject to EPA’s risk management planning requirements. However, sodium hypochlorite is more expensive than chlorine gas, and it degrades quickly if it is exposed to sunlight or is not kept at proper temperatures. For this reason, properly storing delivered sodium hypochlorite in the concentration necessary to disinfect wastewater may require an on-site building with environmental controls. Sodium hypochlorite can also be generated on-site at a wastewater facility using an “electrochlorination system” that produces sodium hypochlorite through an electrical reaction with high-purity salt and softened water. Facilities choosing this method of disinfection reduce chemical costs, but face increased electrical costs from the generation equipment. Because it is a chlorine compound, wastewater facilities using sodium hypochlorite must also be concerned with residual chlorine and hazardous chemical byproducts, such as trihalomethanes.
- *Ultraviolet light.* This disinfection method uses ultraviolet lamps to break down disease-causing microorganisms in wastewater. Wastewater passes through an open channel with lamps submerged below the water level. The lamps transfer electromagnetic energy to an organism’s genetic material destroying the ability of its cells to reproduce. Because ultraviolet light is a physical process rather than a chemical disinfectant, it eliminates the need to generate, handle, transport, or store hazardous and corrosive chemicals. In addition, there are no harmful residual effects to humans or aquatic life. However, ultraviolet light disinfection may not be effective given the turbidity of some wastewater streams. Wastewater facilities using ultraviolet instead of chlorine gas or delivered sodium hypochlorite for disinfection will face additional costs to maintain lamps and increased electrical costs.
- *Ozone.* This disinfection method feeds ozone generated on-site from oxygen exposed to a high-voltage current into a contact chamber containing wastewater. According to EPA, ozone is very effective at destroying viruses and bacteria, but it is the least used disinfection

method in the United States largely because of its high capital and maintenance costs compared to available alternatives.

According to EPA, vulnerability assessments help water systems evaluate susceptibility to potential threats such as vandalism or terrorism and identify corrective actions that can reduce or mitigate the risk of serious consequences. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (the Bioterrorism Act)⁸ required drinking water utilities serving populations greater than 3,300 to complete vulnerability assessments by June 2004.⁹ Wastewater facilities are not required by law to complete vulnerability assessments. Congress has considered bills that would have encouraged or required wastewater treatment plants to assess vulnerabilities, but no such requirement has become law.

In our March 2006 report on wastewater facility security efforts, we found that many large wastewater facilities have either completed a vulnerability assessment or had one underway. Of the 206 large wastewater facilities that responded to our survey, 106 facilities—or 51 percent—reported that they had completed a vulnerability assessment or were currently conducting one. Several other facilities indicated they had conducted or planned to conduct other types of security assessments. Facilities cited several reasons for completing a vulnerability assessment or some other type of security assessment, but most—roughly 77 percent—reported doing so on their own initiative. Many facilities indicated they were combined systems—facilities that manage both drinking water and wastewater treatment. As such, 37 percent of facilities reported that they did some type of security assessment in conjunction with the required assessment for their drinking water facility.

The Clean Air Act requires wastewater facilities that use or store more than 2,500 pounds of chlorine gas to submit to EPA a risk management plan that lays out accident prevention and emergency response activities.

⁸Pub. L. No. 107-188 (2002).

⁹The Bioterrorism Act required the assessments to include, but not be limited to, a review of six components: (1) pipes and constructed conveyances; (2) physical barriers; (3) water collection, pretreatment, treatment, storage, and distribution facilities; (4) electronic, computer, or other automated systems that are utilized by the water system; (5) the use, storage, or handling of various chemicals; and (6) the operation and maintenance of such systems. The act further required systems to prepare or revise an emergency response plan incorporating the results of the vulnerability assessment within 6 months after completing the assessment.

Under this act, EPA requires that about 15,000 facilities—including chemical, water, energy, and other sector facilities—that produce, use, or store more than threshold amounts of chemicals posing the greatest risk to human health and the environment take a number of steps to prevent and prepare for an accidental chemical release. EPA regulations implementing the Clean Air Act require that the owners and operators of chemical facilities include a facility hazard assessment, an accident prevention program, and an emergency response program as part of their risk management plans. The regulations required that a summary of each facility's risk management plan be submitted to EPA by June 21, 1999. The plans are to be revised and resubmitted to EPA at least every 5 years, and EPA is to review them and require revisions, if necessary.

Costs of Preparing Vulnerability Assessments and Risk Management Plans among Large Wastewater Facilities Vary Widely

Although accurate information on the costs of vulnerability assessments and risk management plans is limited, available estimates suggest that their costs vary considerably. A factor contributing to the cost differential was whether they were contracted to third parties (such as engineering consulting firms) or prepared in-house with existing staff. Despite higher costs, some facilities preferred using contractors because their expertise and independence lent credibility to their assessments, which may be useful in obtaining support for security-related upgrades. Costs generally did not relate to facility size, as measured by million of gallons of wastewater treated per day.¹⁰

Vulnerability Assessment Costs Depend Primarily on Whether a Contractor Is Used

The reported cost of preparing vulnerability assessments at the 20 large wastewater facilities where we interviewed officials ranged from \$1,000 to \$175,000. Whether the assessment was done in-house with existing staff or contracted to a third party was a factor contributing to the cost differences. Officials from several facilities told us they used contractors to complete vulnerability assessments in 2002. For example, staff at the Denver Metro Wastewater Reclamation District reported that a contractor completed a vulnerability assessment in November 2002 for its Central Treatment Plant, which treats 130 million gallons of wastewater per day, at

¹⁰In our structured interviews we asked facility managers to provide estimates of their treatment facility's "existing flow" in millions of gallons per day. "Existing flow" refers to the calculated average flow for a recent 12-month period, as defined by EPA in its Clean Water Needs Survey, and is a common measure of treatment facility size. When we note how many gallons per day a facility treats, we are referring to its reported "existing flow."

an estimated cost of \$175,000. Of this cost, \$100,000 was for the contractor, and \$75,000 was estimated for in-house staff time.

Other large wastewater facilities that reported completing vulnerability assessments in 2002 were part of combined systems that provide both drinking water and wastewater services. These systemwide vulnerability assessments were done before the 2002 Bioterrorism Act required drinking water utilities serving populations greater than 3,300 to complete vulnerability assessments by June 2004. The combined systems that conducted systemwide vulnerability assessments include the following:

- *San Antonio Water System (San Antonio, Texas)*. According to system staff, a contractor completed a systemwide vulnerability assessment for all its drinking water, wastewater, and related infrastructure in August 2002 for \$112,000. Staff did not provide an estimate of in-house costs related to the assessment, but prorated the wastewater treatment plants costs related to this contract at \$37,000: \$25,000 for its Dos Rios plant, which treats 70 million gallons per day; \$5,000 each for its Leon Creek and Salado Creek plants, which treat 33 million gallons per day; and \$2,000 for its Medio Creek plant, which treats 5 million gallons per day.
- *The Phoenix Water Services Department (Phoenix, Arizona)*. According to department staff, a contractor completed a systemwide vulnerability assessment for its five drinking water plants, three wastewater plants, and related infrastructure in November 2002 for \$479,725. Staff did not provide an estimate of in-house cost related to the assessment, but estimated the contract costs related to its largest wastewater treatment plant, the 91st Avenue Sewage Treatment Plant, which treats 140 million gallons per day, to be \$100,000.
- *Fort Worth Water Department (Fort Worth, Texas)*. According to department staff, a contractor completed a systemwide vulnerability assessment for its four drinking water plants and one wastewater treatment plant in December 2002 at a cost of \$292,300. Staff did not provide an estimate of in-house cost related to the assessment, but estimated the contract costs related to its Village Creek Wastewater Treatment Plant, which treats 96 million gallons per day, at \$73,075.

Wastewater facility managers cited several reasons for using contractors to complete vulnerability assessments. Staff with the Phoenix Water Services Department told us they used contractors for their vulnerability assessment because a citywide policy required that contract services be used whenever possible. Staff at other wastewater facilities told us that,

despite the higher costs, they preferred to use contractors because of their expertise. According to a wastewater security official, contractor expertise and independence can give contractor findings and recommendations greater credibility with utility governing boards that determine spending priorities.

One manager told us that he used a contractor for a 2002 vulnerability assessment because risk management software and tools were not yet available. After the events of September 11, 2001, EPA provided funding to the Association of Metropolitan Sewerage Agencies¹¹ to develop software, called the Vulnerability Self Assessment Tool (VSAT), for water utilities to use to develop vulnerability assessments. According to a Water Environment Federation (WEF) official, VSAT became available in June 2002. This official also said that EPA provided funding to WEF to provide training workshops to wastewater utilities on how to use VSAT to conduct vulnerability assessments beginning October 2002.¹²

According to interviews with wastewater facility managers, large wastewater facilities that prepared vulnerability assessments in-house with existing staff reported lower costs for preparing the document. These include the following:

- *City of Ventura Public Works Department (Ventura, California).* According to facility staff, in-house staff completed a vulnerability assessment in March 2003 for the Ventura Water Reclamation Facility, which treats 9 million gallons per day, at a cost of roughly \$1,000 in staff time. Facility staff participated in VSAT training sponsored by EPA and completed the assessment using this tool.

¹¹Now the National Association of Clean Water Agencies (NACWA).

¹²Prior to September 11, 2001, EPA worked to develop and disseminate risk assessment methodologies for water utilities. In 2000, EPA funded an initiative with the American Water Works Association Research Foundation (AWWARF) and the Sandia National Laboratories to apply risk assessment methodologies developed by the laboratories to water utilities. The methodology, called the Risk Assessment Methodology for Water Utilities (RAM-W), was designed to assist large water utilities and security professionals in assessing the risks from malevolent threats. Through an interagency agreement with EPA, Sandia National Laboratories provided training to selected firms in the RAM-W methodology so that these firms could then provide training and technical assistance to water utilities.

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- *City of Fort Wayne Utilities Division (Fort Wayne, Indiana).* According to facility staff, in-house staff completed a vulnerability assessment in November 2005 for the Fort Wayne Water Pollution Control Plant, which treats 43 million gallons per day, at undetermined staff time. Facility staff participated in VSAT training and updated a previous risk assessment prepared for the facility by a contractor in 2000 at a contracted cost of \$10,000.
 - *City of Eugene Wastewater Division (Eugene, Oregon).* According to facility staff, in-house staff completed a vulnerability assessment in October 2005 for the Eugene/Springfield Regional Water Pollution Control Facility, which treats 38 million gallons per day, for about \$2,000 in staff time.
 - *City of Cedar Rapids Department of Water Pollution Control (Cedar Rapids, Iowa).* According to facility staff, in-house staff completed a vulnerability assessment in January 2007 for the Cedar Rapids Wastewater Treatment Plant, which treats 35 million gallons per day, for about \$5,000 in staff time.
 - *Detroit Water and Sewerage Department (Detroit, Michigan).* According to department staff, in-house staff completed a vulnerability assessment in January 2005 for the Detroit Wastewater Treatment Plant, which treats 700 million gallons per day, for about \$20,000 in staff time.

Risk Management Plan Costs Also Influenced by Use of Contractors

Costs to prepare risk management plans ranged from less than \$1,000 for facilities that completed the plan in-house to over \$31,000 for facilities that used contractors. Costs to update risk management plans were generally less, ranging from less than \$1,000 to \$20,000 depending upon whether facilities used in-house staff or contractors.

Costs were generally higher at facilities that used contractors. These include the following:

- *The Phoenix Water Services Department (Phoenix, Arizona).* According to department staff, a contractor completed risk management plans for all the system's drinking and wastewater facilities in 1999 for \$230,086. Costs for the 91st Avenue Sewage Treatment Plant were prorated at \$28,761. Department staff said a contractor updated the 91st Avenue plant's risk management plan in 2004 for \$20,000.

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- *Fort Worth Water Department (Fort Worth, Texas)*. According to department staff, a contractor completed risk management plans for all of the department's drinking water and wastewater facilities in 1999 for \$124,718. Costs related to the Village Creek Wastewater Treatment Plant's risk management plan were prorated at \$31,100. Department staff reported that the contractor later updated these risk management plans for \$18,040 in 2004, \$4,510 of which was for the Village Creek plant.
 - *City of Fort Wayne Utilities Division (Fort Wayne, Indiana)*. According to facility staff, a contractor completed a risk management plan in 2001 for the Fort Wayne Water Pollution Control Plant for \$16,000. Facility staff reported a contractor updated the plan in 2005 for \$6,000.
 - *South Central Regional Wastewater Treatment and Disposal Board (Delray Beach, Florida)*. According to facility staff, a contractor completed a risk management plan in 1999 for the South Central Regional Wastewater Treatment and Disposal Plant, which treats 18 million gallons per day, for \$10,000. Facility staff reported a contractor updated it in 2006 for \$2,000.
 - *City of Portland Bureau of Environmental Services (Portland, Oregon)*. According to bureau staff, a contractor completed a risk management plan in 1999 for its Columbia Boulevard Wastewater Treatment Plant, which treats 143 million gallons per day, for \$30,000. Bureau staff reported they updated the plan using in-house staff in 2004 for \$10,000 in staff time.

Other large wastewater facilities that prepared risk management plans in-house with existing staff reported lower costs for preparing the documents. These include the following:

- *San Antonio Water System (San Antonio, Texas)*. According to system staff, in-house staff completed a risk management plan in 1999 for the Dos Rios Wastewater Treatment Plant for between \$5,000 and \$10,000 in staff time. In-house staff updated the plan in 2004 for less than \$1,000 in staff time.
- *City of Cedar Rapids Department of Water Pollution Control (Cedar Rapids, Iowa)*. According to facility staff, in-house staff completed a risk management plan in January 2000 for the Cedar Rapids Wastewater Treatment Plant for \$5,000 in staff time. In-house staff updated the plan in 2004 for about \$250 in staff time.

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- *Denver Metro Wastewater Reclamation District (Denver, Colorado).* According to district staff, in-house staff completed a risk management plan in 1999 for \$10,000 in staff time. In-house staff updated the plan in 2006 for about \$1,000 in staff time.
 - *City of Savannah Water and Sewer Bureau (Savannah, Georgia).* According to facility staff, in-house staff completed a risk management plan in 1999 for the President Street Water Pollution Control Plant, which treats 17 million gallons per day, at a cost of only \$150 in staff time. In-house staff updated the plan in 2006 for about \$130 in staff time.

Costs of Converting to Alternative Disinfection Methods at Large Wastewater Facilities Depend on the Method Used and Other Factors

Large wastewater facilities that convert from chlorine gas disinfection to alternative disinfection processes incur widely varying capital costs, which generally depend on the alternative treatment chosen and facility size. Other factors that affect capital costs include the characteristics of individual facilities, such as whether existing structures can be used, and local factors, such as building costs. Alternative disinfection processes may also pose higher annual operating costs than chlorine gas. However, these costs may be offset, at least somewhat, by savings in training and labor costs, and regulatory burdens associated with the handling of chlorine gas. Some facilities even reported or projected net annual cost savings related to wastewater disinfection.

Disinfection Method Chosen, Facility Size and Characteristics, and Other Factors Determine Capital Conversion Costs

The 23 large wastewater facilities that we interviewed reported capital costs for chlorine conversion ranging from \$646,922 to just over \$13 million. Table 1 identifies the 23 large wastewater facilities that recently converted or plan to convert from chlorine gas to another disinfection method and their reported and planned capital conversion cost.

Table 1: Reported and Planned Disinfection Conversion Costs for Large Wastewater Treatment Facilities

Facility name	Facility location	Conversion year	Facility size (in millions of gallons treated per day) ^a	Disinfection method	Reported or planned conversion cost ^b (in dollars)
Facilities that have completed conversion from chlorine gas					
Chambers Creek	University Place, Wash.	2002	19	Ultraviolet light	\$3,900,608
Blue Plains	Washington, D.C.	2003	307	Sodium hypochlorite	12,980,726
Northeast	Philadelphia, Pa.	2003	190	Sodium hypochlorite	2,600,000
Back River	Baltimore, Md.	2004	150	Sodium hypochlorite	3,300,000
Essex and Union	Elizabeth, N.J.	2004	65	Sodium hypochlorite	775,000
Chesapeake-Elizabeth	Virginia Beach, Va.	2004	21	Sodium hypochlorite	1,225,000
Nansemond	Suffolk, Va.	2004	17	Sodium hypochlorite	1,650,740
Columbia Boulevard	Portland, Ore.	2005	143	Sodium hypochlorite	4,660,490
Valley Creek	Bessemer, Ala.	2005	46	Ultraviolet light	3,561,272
Dry Creek	Fort Wright, Ky.	2005	36	Sodium hypochlorite	646,922
Southern Regional	Boynton Beach, Fla.	2005	22	Sodium hypochlorite ^c	2,592,800
Burbank	Burbank, Calif.	2005	9	Sodium hypochlorite	2,500,000
Southeast	Philadelphia, Pa.	2006	90	Sodium hypochlorite	1,920,000
Papillon	Omaha, Neb.	2006	62	Sodium hypochlorite	3,000,000
Facilities that plan to convert from chlorine gas					
Metro Central	Denver, Colo.	2007	130	Sodium hypochlorite	13,135,000
Fort Wayne	Fort Wayne, Ind.	2007	43	Sodium hypochlorite	1,791,417
Everett	Everett, Wash.	2007	18	Sodium hypochlorite	2,562,460
South Central	Delray Beach, Fla.	2007	18	Sodium hypochlorite ^c	2,454,700
Mill Creek	Cincinnati, Ohio	2008	120	Sodium hypochlorite	3,085,000
Western Branch	Laurel, Md.	2008	20	Ultraviolet light	4,000,000
South Treatment Plant	Renton, Wash.	2009	75	Sodium hypochlorite	2,575,000
Hartford	Hartford, Conn.	2009	51	Ultraviolet light	10,892,000
Eugene-Springfield	Eugene, Ore.	2009	38	Sodium hypochlorite	4,498,000

Source: GAO.

^aPlant size figures are figures for existing flow (a measure of average daily flow) reported by wastewater facilities in our survey.

^bConversion costs were not adjusted for inflation. Figures do not reflect changes in annual costs, but are reported costs for construction, labor, and materials related to the disinfection conversion. Reported conversion costs include actual costs and estimates from facility managers. As such, these cost figures do not represent the present value of the life-cycle cost of conversion. Conversion costs include reported temporary and permanent conversion costs.

^cThese facilities will generate sodium hypochlorite on-site. All other facilities listed as converted or planning to convert to sodium hypochlorite are having the chemical delivered in bulk to the facility.

As shown in the table, 17 of the 23 facilities converted or plan to convert to sodium hypochlorite delivered in bulk to the facility. Officials with several of these facilities told us they considered ultraviolet disinfection, but chose delivered sodium hypochlorite because of its lower capital conversion costs. The remainder converted or plan to convert to sodium hypochlorite generated on-site or ultraviolet light. None of the facilities we contacted adopted ozone.

Interview responses indicate that several factors affect the cost of conversion; among these are disinfection method chosen, facility size, key facility characteristics such as available buildings, and whether the conversion was permanent or temporary, as follows.

Disinfection Method

Generally, conversion to delivered sodium hypochlorite has the lowest capital costs, followed by sodium hypochlorite generated on-site, and followed again by ultraviolet light.¹³ This observation is supported by cost estimates in the Chlorine Gas Decision Tool, a software program released by DHS in March 2006. The decision tool was designed to provide water and wastewater utilities with the means to conduct assessments of alternatives to chlorine gas disinfection. DHS cautions that the final costs of the disinfection systems will depend on project design details, actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors.¹⁴ With these caveats, the decision tool estimates that for a wastewater facility with an average disinfection flow of 10 million gallons per day and a peak disinfection flow of 20 million gallons per day, capital costs for conversion to delivered sodium hypochlorite would amount to \$533,000, on-site generation of sodium hypochlorite would total \$1,238,000, and ultraviolet disinfection would reach \$1,526,000.¹⁵

¹³Conversion to disinfection methods such as ozone and ultrafiltration can have higher capital costs than ultraviolet light.

¹⁴The decision tool provides cost estimates for disinfection conversion alternatives where there is limited site-specific engineering data. DHS notes that cost estimates were based on cost curves that were developed from a combination of the actual construction costs of different-sized disinfection systems and cost estimates based on conceptual designs.

¹⁵DHS notes that it is normally expected that an estimate of this type would be accurate within +50 percent to -30 percent.

Our interviews with wastewater facilities provide specific examples of conversion costs. For example, managers of the Chesapeake-Elizabeth Treatment Plant, which treats 21 million gallons per day and serves customers in Virginia Beach, Virginia, reported spending an estimated \$1,225,000 in 2004 converting to bulk sodium hypochlorite disinfection. Managers of the comparably sized Western Branch Wastewater Treatment Plant, which treats 20 million gallons per day and serves customers in Laurel, Maryland, estimated that they will spend \$4 million converting to ultraviolet light disinfection by January 1, 2008. Managers of the Western Branch plant indicated that one reason they chose the more expensive ultraviolet treatment option over bulk deliveries of sodium hypochlorite was to avoid the risk to local traffic that could result from additional deliveries to the plant. Plant managers indicated that because sodium hypochlorite degrades more quickly than chlorine gas, truck deliveries would increase under a disinfection system using sodium hypochlorite. They also noted that ultraviolet light disinfection would eliminate the need for the facility to handle and store significant amounts of hazardous and corrosive chemicals.

Facility Size

In addition to disinfection method chosen, facility size can also influence capital conversion costs. In general, larger facilities spend more converting to alternative disinfection methods. For example, because larger facilities process a greater flow of wastewater, converting to delivered sodium hypochlorite would require a larger sodium hypochlorite storage building or buildings relative to a smaller facility. It may also require additional pumps, instrumentation, and piping to deliver treatment chemicals to a greater number of contact tanks. Importantly, the largest facilities also tend to serve high-cost urban areas, and their conversion costs reflect the higher costs for construction materials and contract labor in these markets.

For example, the Blue Plains Wastewater Treatment Plant, which treats 307 million gallons per day and serves over 2 million customers in the Washington, D.C., metropolitan area, converted from chlorine gas to delivered sodium hypochlorite in 2003 at a cost of almost \$13 million. According to facility managers, the facility temporarily converted from chlorine gas to delivered sodium hypochlorite in April 2002 at a cost of \$500,000, primarily for storage tanks, pumps, piping, and related instrumentation. It completed the permanent conversion in October 2003 at an added cost of about \$12.5 million, which included the purchase of additional storage tanks, related pumps, piping and instrumentation, and the construction of storage facilities for sodium hypochlorite and sodium bisulfate (used for dechlorination).

Other Key Facility Characteristics

In addition to facility size, other physical characteristics related to individual facilities also play a large role in conversion costs. For instance, the availability of usable buildings on facility grounds will determine whether a facility needs to construct, expand, or update a building to properly house sodium hypochlorite and its associated metering equipment. In addition, the distance between the storage building and treatment tanks will determine the amount of piping needed to deliver stored sodium hypochlorite to the treatment tanks. An example comes from the Hampton Roads Sanitation District which provides wastewater treatment to approximately 1.6 million people in 17 cities and counties in southeast Virginia, including the cities of Newport News, Norfolk, Suffolk, Virginia Beach, and Williamsburg. In 2004, the sanitation district converted from chlorine gas to bulk sodium hypochlorite disinfection at two of its plants—the Nansemond Treatment Plant, which treats 17 million gallons per day for the city of Suffolk, and the previously mentioned Chesapeake-Elizabeth plant, which treats 21 million gallons per day. The Nansemond plant conversion cost an estimated \$1.65 million, while the slightly larger Chesapeake-Elizabeth plant conversion cost about \$1.2 million. Costs were higher at the Nansemond plant because a building needed to be constructed for sodium hypochlorite storage, while the Chesapeake-Elizabeth plant had an existing building that only needed to be upgraded to properly store the chemical.

Federal discharge permit requirements related to individual treatment facilities can also influence conversion costs. Certain wastewater facilities may be allowed higher chlorine residuals in treated effluent because they discharge into less sensitive waters. Often, these facilities do not have to dechlorinate wastewater, saving the facility the cost of dechlorination chemicals, equipment, and storage. For example, the Philadelphia-area Southeast and Northeast Wastewater Treatment Plants, which treat 90 and 190 million gallons per day, respectively, need only to chlorinate water prior to discharging into the Delaware River. Both plants were converted to delivered sodium hypochlorite—the Southeast plant in 2006 at an estimated cost of \$1.9 million and the Northeast plant in 2003 at an estimated cost of \$2.6 million. In contrast, the Baltimore-area Back River Wastewater Treatment Plant, which treats 150 million gallons per day and discharges into the ecologically sensitive Chesapeake Bay, must chlorinate and dechlorinate its wastewater before discharge. This facility converted to delivered sodium hypochlorite in 2004 at a reported cost of \$3.3 million.

Temporary Conversions

Finally, some facilities have reduced conversion costs in the short term through temporary conversions. For example, the Metropolitan Sewer District of Greater Cincinnati decided to convert its Mill Creek Wastewater

Treatment Plant, which treats 120 million gallons per day, from chlorine gas to sodium hypochlorite disinfection soon after September 11, 2001. According to the plant manager, by mid-October 2001, the facility had begun disinfecting with sodium hypochlorite by hooking up a rented sodium hypochlorite trailer to its disinfection system at a cost of \$25,000. By May 2002, the facility had completed an interim conversion to sodium hypochlorite by purchasing and installing two 8,000 gallon outdoor storage tanks for sodium hypochlorite at a cost of \$60,000. According to the plant manager, this interim disinfection system is still in use today, though the plant intends to permanently convert to delivered sodium hypochlorite in 2008 or 2009 at an estimated cost of \$3 million. The plant manager said the permanent conversion would include an unloading station for sodium hypochlorite deliveries and a new storage building for the chemical and related instrumentation. The plant manager said the new storage building was needed to reduce the decay of stored sodium hypochlorite. The plant manager added that the storage building and additional piping would improve plant safety because it would allow for central storage and delivery of sodium hypochlorite. Currently, sodium hypochlorite deliveries are made at several plant locations for odor control which, according to the plant manager, increase the odds the chemical may be mishandled and accidentally mixed with other reactant chemicals used at the plant, such as ammonia.

Similarly, the Eastern Water Reclamation Facility, which treats 16 million gallons per day and provides service to Orange County, Florida, converted from chlorine gas to sodium hypochlorite disinfection at a cost of \$60,000 in November 2001 through the addition of outdoor storage tanks and related pumps. According to the plant manager, the facility may consider additional changes in the future, such as permanent sodium hypochlorite storage or on-site generation.

Changes in Annual Costs Vary Widely, with Some Facilities Reporting Savings

Changes in annual costs related to disinfection treatment conversions were hard to measure due to lack of data. Many facilities we interviewed were unable to provide complete information on annual costs related to disinfection before and after converting from chlorine gas. Available data show that annual chemical costs related to disinfection increased for facilities that converted to delivered sodium hypochlorite, because sodium

hypochlorite costs more than chlorine gas.¹⁶ Available data also show that electrical costs related to disinfection increased for facilities that converted to on-site generation of sodium hypochlorite or ultraviolet light treatment, however these facilities also saw large reductions in chemical costs. Available data also show that increases in annual costs related to disinfection were offset somewhat by savings in training and regulatory requirements, as several facilities that converted reported a reduced need for staff time devoted to complying with the EPA risk management planning that was required when the plant used chlorine gas.

A few facilities were even able to report or project annual savings due to the disinfection conversion. For example, the wastewater treatment manager of the Columbia Boulevard Treatment Plant, which treats 143 million gallons per day and provides wastewater service to Portland, Oregon, estimated that annual costs related to disinfection fell by over \$100,000 after the plant completed a 2005 conversion from chlorine gas to delivered sodium hypochlorite disinfection.¹⁷ According to the wastewater treatment manager, increases in disinfection chemical costs for the plant were more than offset by reductions in electrical, labor, and training costs. Electrical power costs fell because the plant no longer had to power chlorine gas evaporators, which heat and help convert the pressurized liquid into gas before it is injected into the waste stream. In contrast, sodium hypochlorite is fed into the waste stream via less energy-intensive pumps. Labor and training costs also fell because the plant no longer had to meet the Occupational Safety and Health Administration's (OSHA) Process Safety Management of Highly Hazardous Chemicals standard,¹⁸ and risk management and emergency response planning costs associated with the use of chlorine gas were eliminated.

¹⁶In addition, sodium bisulfate, the dechlorination chemical often used with sodium hypochlorite, costs more than sulfur dioxide, the dechlorination chemical often used with chlorine gas.

¹⁷According to the wastewater treatment manager, annual costs related to disinfection fell from \$411,531 for the operating year covering July 1, 2004, to June 30, 2005, to \$302,998 for the operating year covering July 1, 2005, to June 30, 2006. The wastewater treatment manager reported the plant's annual operations and maintenance budget at \$12.4 million for the most recently completed operating year.

¹⁸OSHA's Process Safety Management of Highly Hazardous Chemicals standard (29 CFR 1910.119) contains requirements for the management of hazards associated with processes using highly hazardous chemicals.

In another example, the South Central Regional Wastewater Treatment and Disposal Plant, which treats 18 million gallons per day for customers in the cities of Delray Beach and Boynton Beach, Florida, predicts that it too will achieve annual savings once it converts from chlorine gas to sodium hypochlorite generated on-site, which it anticipates completing in September 2007. According to the Executive Director of the South Central Regional Wastewater Treatment and Disposal Board, potential disruptions of sodium hypochlorite delivery during hurricane seasons motivated them to begin generating their disinfection chemicals on-site. The plant's most recent fiscal year operating and maintenance budget for disinfection is estimated to be roughly \$307,000 for chlorine gas and associated costs including equipment and maintenance, labor, and risk management planning. Postconversion annual operating and maintenance costs for disinfection are estimated to fall to \$205,000 in the 2008 calendar year, primarily due to the suspension of chlorine gas purchases.

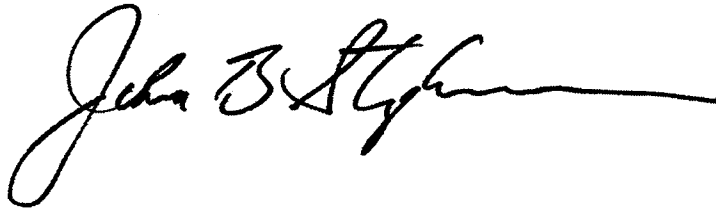
Agency Comments and Our Evaluation

We provided a draft of this report to EPA for review and comment. In its letter, reproduced in appendix II, EPA concurred with the results of the report. EPA's Water Security Division in the Office of Ground Water and Drinking Water provided technical comments and clarifications that were incorporated, as appropriate.

As agreed with your office, unless you publicly release the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of this report to the appropriate congressional committees; interested Members of Congress; the Administrator, EPA; and other interested parties. We will also make copies available to others on request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

Should you or your staff need further information, please contact me at (202) 512-3841 or stephensonj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix III.

Sincerely yours,

A handwritten signature in black ink, reading "John B. Stephenson". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

John B. Stephenson
Director, Natural Resources
and Environment

Appendix I: Scope and Methodology

To identify the costs of preparing vulnerability assessments and risk management plans, we conducted structured telephone interviews with a select sample of large wastewater facilities identified as having completed these documents in our March 2006 report.¹ Our March report identified 106 large facilities that reported they had prepared vulnerability assessments or had one underway, and 85 facilities that were required to prepare risk management plans because they currently used chlorine gas as a disinfectant. From these two groups, we identified 47 facilities that reported that they had prepared vulnerability assessments and currently use chlorine. Of this universe, we chose a nonprobability sample of 25 facilities to assure geographic dispersion and adequate variation in size, since these factors were likely to influence their costs.² We completed structured interviews with 20 of the remaining 25 facilities. We sent an interview schedule in advance of each of the interviews. We completed the structured interviews between November 2006 and February 2007. Reported costs included both actual and estimated costs. For estimated costs, we asked facility managers to explain how they arrived at these estimates. Reported costs were not adjusted for inflation.

To identify the costs incurred by wastewater facilities in converting from gaseous chlorine to an alternative disinfection process, we conducted structured telephone interviews with a nonprobability sample of 26 of the 38 large facilities identified in the March report as having recently converted or planning to convert from chlorine gas to an alternative disinfection process. We sent an interview schedule in advance of each of the interviews. We completed the structured interviews between October 2006 and February 2007. Reported costs included both actual and estimated costs. For estimated costs, we asked facility managers to explain how they arrived at these estimates. Reported costs were not adjusted for inflation. We also conducted site visits with some of the facilities. Where available, we gathered documentation, such as capital plans, from these facilities in order to document conversion costs. We supplemented the cost information we gathered at individual wastewater

¹GAO, *Securing Wastewater Facilities: Utilities Have Made Important Upgrades but Further Improvements to Key System Components May Be Limited by Costs and Other Constraints*, GAO-06-390 (Washington, D.C.: Mar. 31, 2006). We defined large wastewater facilities as those publicly owned treatment works (POTW) that serve residential populations of 100,000 or greater.

²Results from nonprobability samples cannot be used to make inferences about a population, because in a nonprobability sample some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample.

facilities with information obtained at the Environmental Protection Agency, the Department of Homeland Security, nongovernmental organizations, and industry representatives. We determined that reported cost data were sufficiently reliable to provide useful information about the costs for preparing vulnerability assessments, risk management plans, and conversions from gaseous chlorine and the factors that affect these costs.

We conducted our work between August 2006 and March 2007 in accordance with generally accepted government auditing standards.

Appendix II: Comments from the Environmental Protection Agency



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 20 2007

OFFICE OF
WATER

Mr. John B. Stephenson
Director, Natural Resources and the Environment
Government Accountability Office
Washington, DC 20548

Dear Mr. Stephenson:

Thank you for the opportunity to review the draft Government Accountability Office (GAO) Report *Securing Wastewater Facilities: Costs of Vulnerability Assessments, Risk Management Plans, and Alternative Disinfection Methods Vary Widely*. We appreciate the information in the report. This draft report is useful, well thought out, and demonstrates a well conceived and executed project. Our review did not identify any issues of concern for the Agency and my staff has provided GAO with technical comments on the draft under a separate cover.

We all rely on clean, safe, and secure water. Therefore, from a public health and economic perspective, it is critical that we protect our nation's wastewater infrastructure. Although there are no federal statutory requirements for wastewater utilities to conduct risk assessments, the Environmental Protection Agency (EPA) continues to develop tools and provide training to assist those water sector utilities that choose to perform these assessments on a voluntary basis. As your report notes, many wastewater utilities have elected to conduct these assessments or are planning to do so in the future.

The Agency is also interested in working with the water sector to identify disinfectants that are appropriate for their needs to meet water quality standards and to protect human health and the environment. Although the conversion from gaseous chlorine to an alternate disinfectant would eliminate the impacts of a hazardous gaseous chemical release, it is important to recognize that water sector utility owners and operators need to make the choice of disinfectant that is best for their utility. Therefore, many water sector utilities may continue to use chlorine gas as a disinfectant.

I appreciated the opportunity to coordinate with your staff on this project. Should you need additional information or have further questions, please contact me or Cynthia C. Dougherty, Director of the Office of Ground Water and Drinking Water at (202) 564-3750.

Sincerely,

A handwritten signature in black ink, appearing to read "B. Grumbles".

Benjamin H. Grumbles
Assistant Administrator

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Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

John B. Stephenson, (202) 512-3841 or stephensonj@gao.gov

Acknowledgments

In addition to the contact named above, Jenny Chanley, Steve Elstein, Nicole Harris, Greg Marchand, Tim Minelli, Alison O'Neill, Daniel Semick, and Monica Wolford made key contributions to this report.

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ATTACHMENT 4

Attachment 4

Railroad Industry Recommended Operating Practice and Security Initiatives

1. OT-55 (Recommended Railroad Operating Practices for Transportation of Hazardous Materials)

AAR's member railroads have adopted operating restrictions for the transportation of TIH and other highly hazardous materials, embodied in Circular OT-55. OT-55 provides that a train transporting five or more tank cars containing highly-hazardous materials will:

- be operated at a maximum operating speed of 50 mph;
- hold the main track at meeting or passing points if the siding does not meet FRA Class 2 standards, when practicable;
- transport only cars equipped with roller bearings; and
- when a bearing defect in a car is reported by a wayside detector and a visual inspection fails to confirm a defect, the train will proceed at a maximum speed of 30 mph until it passes over the next wayside detector (or reaches a terminal) and if the next detector also reports a defect, the car will be set out from the train.

In addition, for routes with high volumes of highly-hazardous materials:

- wayside bearing defect detectors will be spaced no more than 40 miles apart;
- main track will be inspected by rail defect detection and track geometry inspection cars at least twice annually (sidings will be inspected at least once annually); and
- track used for meeting and passing trains transporting five or more TIH materials must be Class 2 or higher (if a track of a lesser class must be used in an emergency, one of the trains must stop).

OT-55 contains other restrictions on TIH transportation as well:

- loaded TIH cars cut off in motion must be handled in cuts of no more than two cars and cars that will be cut off in motion and coupled to a loaded TIH car must be handled in cuts of no more than two cars;
- for new facilities, the loading and unloading of TIH materials and the storing of TIH materials in tanks must take place at least 100 feet from mainline class 2 track or higher, and loaded TIH tank cars must be stored at least 50 feet from mainline class 2 track or higher.

2. AAR terrorism risk analysis and Security Management Plan

In response to the terrorist attacks of September 11, 2001, the railroad industry created critical action teams to perform risk assessments regarding the transportation of hazardous materials (with emphasis on TIH materials). Their work culminated in 53 permanent security countermeasures.

In addition, the industry prepared a Security Management Plan with four threat-based Alert Levels. Railroads implement specific security actions as the alert level changes. Many security actions relate directly to the transportation of TIH materials. The Security Plan is regularly exercised, reevaluated, and updated.

To monitor threat and warning information, the railroads created the Railway Alert Network (RAN), a 24x7 secure facility that operates at the Secret level. The industry also established the Surface Transportation Information Sharing and Analysis Center (ST-ISAC) to operate as a backup capability for the RAN and to monitor cyber security threats. The ST-ISAC operates 24x7 at the Top Secret Level. The railroad industry is in constant communication with government intelligence agencies to monitor threat and warning information.

3. Industry research efforts relating to TIH materials transportation

The railroad industry has also devoted considerable resources in research efforts to enhance the security of tank cars transporting TIH materials. The industry is examining with DOT/TSA technology that would enable a tank car to self-seal in the event the car is penetrated by ammunition; that would make tank cars more resistant to penetration; and that would sense a release of TIH.

ATTACHMENT 5

Attachment 5
DOT and TSA Initiatives Related to TIH Materials Transport

I. DOT/Pipeline and Hazardous Materials Safety Administration (PHMSA) requirements for TIH materials safety and security plans, 49 C.F.R. § 172.820 (interim rule) [73 FR 20752 (April 16, 2008)]

1. Rail carriers transporting TIH materials must compile information and data on the commodities transported, including the routes over which these commodities are transported.
2. Rail carriers transporting TIH materials must use the data they compile (including relevant information from state officials) regarding security risks to high-consequence targets along or in proximity to a route to analyze the safety and security risks for each route used and practicable alternative routes to the route used.
3. Using these analyses, rail carriers must select the route posing the least overall safety and security risk for the TIH materials (taking into account twenty-seven relevant factors).
4. The railroads must compile the data for TIH materials movements and conduct the route analyses on an annual basis.
5. Rail carriers must institute measures to prevent unauthorized access to TIH materials during storage and mitigate storage risks to population centers.
6. Rail carriers transporting TIH materials must notify consignees of any significant unplanned delays affecting the delivery of the TIH material.
7. Rail carriers must work with shippers and consignees to minimize the time a rail car containing TIH material is placed on track awaiting pick-up, delivery, or transfer.
8. Rail carriers must conduct security visual inspections at ground level of rail cars containing TIH to check for signs of tampering or the introduction of an improvised explosive device (IED).

II. PHMSA speed limit requirements for TIH transportation, proposed 49 C.F.R. § 174.826 [73 Fed. Reg. 17818 (April 1, 2008)]

PHMSA has proposed two speed limit requirements for TIH rail transportation as part of its proposal to require upgraded TIH materials tank car specifications:

1. Trains transporting TIH materials would be subject to a 50 mph limit (current railroad industry practice only limits trains transporting five or more tank cars containing TIH materials to 50 mph).
2. Trains transporting TIH materials in tank cars that do not meet the upgraded specifications would be subject to a 30 mph restriction in non-signalized territory.

III. Transportation Security Administration (TSA) Rail Transportation Security Regulations (proposed 49 C.F.R. Part 1580) [71 FR 76852 (December 21, 2006)]

TSA's proposed rules would impose various security requirements upon rail carriers transporting TIH materials:

1. Rail Security Coordinator. A carrier must designate a rail security coordinator (RSC) and at least one alternate RSC to be available to TSA on a twenty-four hour, seven day per week basis to serve as primary contact for receipt of intelligence information and other security-related activities. Proposed 1580.101
2. Reporting. A carrier must immediately report incidents, potential threats, and significant security concerns to TSA. Proposed 1580.105
3. Location and Shipping Information. A carrier must provide to TSA, upon request, the location and shipping information of rail cars within its physical custody or control that contain TIH materials. The information must be provided to TSA no later than one hour after receiving the request. Proposed 1580.103
4. Chain of Custody and Control. A carrier must provide for a secure chain of custody and control of rail cars containing TIH materials. The carrier must document the transfer of custody of a rail car containing TIH from a shipper regardless of whether the carrier is physically accepting the rail car at a shipper facility located outside or inside an HTUA. The carrier must also perform a physical security inspection on the car to ensure that no one has tampered with it or otherwise compromised its security. With respect to transfers within an HTUA, each delivering carrier transferring physical custody of a rail car containing TIH to a receiving carrier must ensure that the receiving carrier takes physical possession of the rail car before the delivering carrier leaves the interchange point. Both carriers must ensure that the rail car is attended at all times during the physical transfer of custody. The same requirements would apply whenever a carrier transfers or receives a rail car containing TIH if the rail car may subsequently enter an HTUA. Proposed 1580.107

IV. TSA Security Action Items

TSA (on June 23, 2006) issued twenty-four "Recommended Security Action Items for the Rail Transportation of Toxic Inhalation Hazard Materials" which require carriers to:

1. Designate an individual with overall responsibility for hazardous materials transportation security planning, training, and implementation (including with respect to company-designated critical infrastructure).
2. Conduct exercises, at least annually, to verify the effectiveness of security plan(s).
3. Develop and conduct an internal or external company audit program to independently verify that the security plan is being effectively implemented.
4. Identify and annually review company-designated critical infrastructure.
5. Maintain a communications network to receive timely government notices of current threat conditions and available intelligence information and adjust security measures as necessary.
6. Establish liaison and regular communication with federal, state, and local law enforcement, emergency responders, security agencies, and industry partners.

7. Establish liaison and collaboration with other railroad security offices to promote information sharing and security enhancements.
8. Reinforce security awareness and operational security concepts to all employees.
9. Reinforce the need for employees to immediately report to the proper authorities all suspicious persons, activities, or objects encountered.
10. Have contingency plans in place to supplement company security personnel to protect company-designated critical infrastructure as threat conditions warrant.
11. Restrict access to information controlled by the railroad that it determines to be sensitive, in particular information about hazardous materials shipments and security measures.
12. Make available emergency response planning materials, and work with local communities to facilitate their training and preparation to respond to an emergency or security incident.
13. Work with the federal, state, local, and tribal governments to identify through risk assessments those locations where security risks are the highest and implement protective measures at these locations.
14. Focus proactive community safety and security outreach and trespasser abatement programs in areas adjacent to company-designated critical infrastructure
15. To the extent feasible and practicable, utilize photo identification procedures for company-designated critical infrastructure. Establish procedures for background checks and safety and security training for contractor employees.
16. To the extent feasible and practicable, and as threat conditions warrant, restrict the access of contractors and visitors at non-public areas of company-designated critical infrastructure and monitor the activities of visitors in or around such infrastructure.
17. Establish employee identification measures for all employees and conduct spot checks as threat conditions warrant.
18. Implement measures to deter unauthorized entry and increase the probability of detection at company-designated critical infrastructure as threat conditions warrant.
19. Utilize interlocking signals and/or operating rules to prevent trains from occupying moveable bridges until they are locked in place.
20. Maintain systems to locate rail cars transporting TIH materials in a timely manner and provide information on the location of rail cars carrying TIH materials to DHS and DOT as requested.
21. During required on-ground safety inspections of cars containing TIH materials, inspect for any apparent signs of tampering, sabotage, attached explosives, and other items. Train employees to recognize suspicious activity and report security concerns found during inspections.
22. Provide local authorities with information on the hazardous materials transported through their communities consistent with AAR Circular OT-55.
23. Consider alternative routes when they are economically practicable and result in reduced overall safety and security risks. Work with the DHS and DOT in developing better software tools to analyze routes.

24. In rail yards, to the extent feasible, place cars containing TIH materials where the most practical protection can be provided against tampering and outside interference in accordance with the AAR Security Management Plan.

TSA also issued three supplemental security action items on November 21, 2006 which require that:

1. Rail carriers with operations in High Threat Urban Areas (HTUA) must develop site-specific security plans that address the security of TIH material in loaded rail cars ("TIH cars") within HTUA. The site-security plan must address the following objectives:
 - Reduce the number of hours TIH cars are held in yards, terminals, and on railroad-controlled leased track in HTUA.
 - Minimize the occurrence of unattended TIH cars in HTUA.
 - Reduce potential exposure to surrounding people, property and environment in HTUA with special emphasis on reducing potential exposure to hospitals, high-occupancy buildings, schools, and public venues.
 - Reduce the occurrence of standing TIH trains in HTUA.
 - Provide procedures for the protection or surveillance of unattended TIH trains in HTUA
 - Ensure compliance with CFR 49 Part 174.14 (48 hour rule).¹
 - Develop site-specific procedures for the positive and secure handoff of TIH cars at points of origin, destination, and interchange in HTUA.
2. Rail carriers will not operate trains carrying TIH within a specified distance of public venues with National Special Security Events in progress and as requested by the appropriate agency responsible for overall event security coordination.
3. Rail carriers will, in the security planning process, identify and select areas throughout the carrier's system where cars containing TIH can be moved and held when threat conditions warrant.

(The railroads have taken specific actions and otherwise modified their operating procedures in compliance with the TSA security action items. For example, the railroads have reported and reduced dwell time for TIH materials in HTUA; have changed operating procedures so that when TIH materials are held during transportation, they are placed away from public facilities, such as hospitals and schools, and placed in active yards rather than on "unattended" tracks; have moved interchange locations away from HTUA; have installed lights, fences, intrusion detection systems, and cameras; and have developed site-specific security plans.)

¹ 49 C.F.R. 174.14 provides that:

(a) A carrier must forward each shipment of hazardous materials promptly and within 48 hours (Saturdays, Sundays, and holidays excluded), after acceptance at the originating point or receipt at any yard, transfer station, or interchange point, except that where biweekly or weekly service only is performed, a shipment of hazardous materials must be forwarded on the first available train.